DOCUMENT RESUME

ED 382 883 CE 069 216

AUTHOR McCormick, Alexander C.; And Others
TITLE Vocational Course Taking and Achievement: An Analysis of High School Transcripts and 1990 NAEP Assessment Scores. Statistical Analysis Report.
INSTITUTION MPR Associates, Berkeley, CA.
SPONS AGENCY National Center for Education Statistics (ED), Washington, DC.
REPORT NO ISBN-0-16-048073-6; NCES-95-006
PUB DATE May 95
NOTE 73p.
AVAILABLE FROM U.S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328.
PUB TYPE Reports - Research/Technical (143) -- Statistical Data (110)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Academic Achievement; Academic Education; Course Selection (Students); High Schools; *Outcomes of Education; *Research Methodology; *Test Use; *Vocational Education
IDENTIFIERS *National Assessment of Educational Progress

ABSTRACT

A study sought to determine the relationship between vocational course taking and academic achievement as measured by the 1990 National Assessment of Educational Progress (NAEP). Analysis of the data measured by the NAEP shows a consistent inverse relationship between vocational course taking and NAEP assessment scores. The relationship holds for mathematics, science, and reading achievement. This association persists after attempts are made to take other curriculum characteristics and background characteristics into account, although it attenuates among students whose parents did not complete high school. Despite the consistent finding that vocational course taking is inversely related to achievement on the NAEP tests, this cannot be taken as evidence that increased vocational course taking depresses achievement. Rather, it might be found that students who generally score lower on tests also tend to take vocational courses, or that students who take vocational courses miss the academic courses that may help increase test scores. (Twenty-three tables, three figures, as well as a summary of the study's methodology, are included.) (KC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 382 883

NATIONAL CENTER FOR EDUCATION STATISTICS

Statistical Analysis Report May 1995

Vocational Courses Taken and Achievement: An Analysis of High School Graduates in 1990 and 1992

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

U.S. Department of Education
Office of Educational Research and Improvement NCES 95-026

CE069 216

BEST COPY AVAILABLE

2

NATIONAL CENTER FOR EDUCATION STATISTICS

Statistical Analysis Report May 1995

Vocational Course Taking and Achievement: An Analysis of High School Transcripts and 1990 NAEP Assessment Scores

Alexander C. McCormick
John Tuma
MPR Associates, Inc.

James D. Houser
Data Development Division
National Center for Education Statistics

U.S. Department of Education
Office of Educational Research and Improvement NCES 95-006

U.S. Department of Education
Richard W. Riley
Secretary

Office of Educational Research and Improvement
Sharon P. Robinson
Assistant Secretary

National Center for Education Statistics
Emerson J. Elliott
Commissioner

National Center for Education Statistics

"The purpose of the Center shall be to collect, and analyze, and disseminate statistics and other data related to education in the United States and in other nations."—Section 406(b) of the General Education Provisions Act, as amended (20 U.S.C. 1221e–1).

May 1995

Contact:
James Houser
(202) 219–1419

For sale by the U.S. Government Printing Office
Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328
ISBN 0-16-048073-6

Commissioner's Statement

This report describes the relationship between vocational course taking and academic achievement as measured by the 1990 National Assessment of Educational Progress (NAEP). The report is being produced pursuant to a mandate in Section 421(h) of the Carl D. Perkins Vocational and Applied Technology Education Act of 1990, which requires that NAEP collect and report data on the educational achievement of students participating in vocational education.

The purpose of this report is to provide baseline data on the relationship between vocational course taking and NAEP test scores. While the NAEP data can be used to describe these relationships, cross-sectional data such as the NAEP (which represent only a single point in time) cannot by themselves be used to explain why these relationships exist. For example, students who earned a large number of credits in vocational education tended to have lower scores on the NAEP achievement tests than did students who earned relatively few credits in vocational education. The inverse relationship between vocational course taking and NAEP scores could reflect a variety of factors, such as:

- students who tend to have lower scores on tests such as NAEP may be more likely than students with higher scores to participate in vocational education;

- students who participate extensively in vocational education and those who attain relatively low NAEP scores may share some other characteristic, such as being from a disadvantaged group; or

- students who participate heavily in vocational education may take fewer academic courses, which in turn may be related to their NAEP performance.

Since the reasons for the relationships between vocational course taking and academic achievement cannot be determined with NAEP data, I caution against drawing conclusions about causation based on the NAEP data presented in this report.

Emerson J. Elliott
Commissioner of Education Statistics

Acknowledgments

The authors would like to thank all those who contributed to the production of this report. At MPR Associates, Andrea Livingston edited the final report, and Lynn Sally, Angie Wei, Phil Pierpont, and Karen Singson prepared the tables and provided essential production assistance. Ellen Liebman did the programming and provided assistance in working with the NAEP data files.

At the National Center for Education Statistics (NCES), guidance for this project was provided by Jeanne Griffith, the Associate Commissioner for Data Development, and John Ralph, the Branch Chief for the Data Development Division. Mary Frase, also from the Data Development Division, reviewed and edited the report. The authors would also like to thank Andrew Kolstad and Jerry West at NCES, Carol Griffiths at the Office of Vocational and Adult Education, and Lisa Hudson at the Office of Educational Research and Improvement for their thoughtful reviews and helpful comments.

Table of Contents

Commissioner's Statement iii
Acknowledgments iv
List of Tables vi
List of Figures viii
Introduction 1
Vocational Course Taking and NAEP Assessment Scores 4
The Relationship between Measures of Curricular Participation and NAEP Test Scores . 4
The Relationship between Demographic Characteristics and NAEP Test Scores 7
Summary of Findings 11
References 12
Appendix A: Tables 13
Appendix B: Methodology and Statistical Procedures 43

List of Tables

Text tables **Page**

A Average number of credits earned by public high school graduates in vocational, academic, and personal use courses by NAEP assessment quartiles: 1990 5

B Average NAEP mathematics score for public high school graduates, by vocational credits and curriculum characteristics: 1990 6

C Average NAEP mathematics score for public high school graduates, by vocational credits and selected background characteristics: 1990 9

Detailed tables

1 Average NAEP mathematics score for public high school graduates, by vocational credits and curriculum characteristics: 1990 14

2 Average NAEP science score for public high school graduates, by vocational credits and curriculum characteristics: 1990 16

3 Average NAEP reading score for public high school graduates, by vocational credits and curriculum characteristics: 1990 17

4 Average NAEP mathematics score for public high school graduates, by vocational credits and selected background characteristics: 1990 18

5 Average NAEP science score for public high school graduates, by vocational credits and selected background characteristics: 1990 19

6 Average NAEP reading score for public high school graduates, by vocational credits and selected background characteristics: 1990 20

7 Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP mathematics assessment score quartiles and curriculum characteristics: 1990 21

8 Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP science assessment score quartiles and curriculum characteristics: 1990 24

9 Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP reading assessment score quartiles and curriculum characteristics: 1990 26

10 Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP mathematics assessment score quartiles and selected background characteristics: 1990 28

11 Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP science assessment score quartiles and selected background characteristics: 1990 30

12 Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP reading assessment score quartiles and selected background characteristics: 1990 32

13 Distribution of public high school graduates across levels of vocational course taking, by selected background characteristics: 1990 NAEP mathematics assessment sample 34

14 Distribution of public high school graduates across levels of vocational course taking, by selected background characteristics: 1990 NAEP science assessment sample 35

15 Distribution of public high school graduates across levels of vocational course taking, by selected background characteristics: 1990 NAEP reading assessment sample 36

16 Distribution of public high school graduates across levels of vocational course taking, by curriculum characteristics: 1990 NAEP mathematics assessment sample 37

17 Distribution of public high school graduates across levels of vocational course taking, by curriculum characteristics: 1990 NAEP science assessment sample . . . 39

18 Distribution of public high school graduates across levels of vocational course taking, by curriculum characteristics: 1990 NAEP reading assessment sample . . 40

19 Standard errors and unweighted Ns for table A 41

Appendix table

B.1 Percentage distribution of public high school graduates in the 1990 High School Transcript Study sample and the joint NAEP assessment-transcript samples, by number of vocational credits completed 46

List of Figures

Figure		Page
1	Average NAEP mathematics assessment score for public high school graduates, by compliance with *A Nation at Risk* recommendations and number of vocational credits: 1990	8
2	Average NAEP mathematics assessment score for public high school graduates, by number of vocational credits and parents' highest level of education: 1990	10
B.1	Organization of the Secondary School Taxonomy	45

Introduction

This report describes the relationship between vocational course taking among 1990 public high school graduates and their academic achievement on the 1990 National Assessment of Educational Progress (NAEP). It draws upon two data sets: the 1990 NAEP grade 12 assessments, and the 1990 High School Transcript Study (HSTS), which contains transcript data for a nationally representative sample of 1990 graduates of high schools that were also sampled for the 1990 NAEP.[1] The report focuses primarily on relationships between vocational course taking and performance on the NAEP math assessment, but these relationships generally hold for the reading and science assessments as well. Relationships between course taking and NAEP scores are also very briefly examined by selected student background characteristics (parents' educational attainment and race-ethnicity) to illustrate some unique features of the relationship between course taking and achievement and to aid in the interpretation of these data. Interested readers can explore the relationships described in this report in greater detail by referring to the tables in appendix A.

The Carl D. Perkins Vocational and Applied Technology Education Act of 1990 (hereafter referred to as the 1990 Perkins Act) calls upon schools receiving federal vocational education funds to use these funds in programs that integrate academic and vocational education. This provision reflected recommendations made by the 1989 National Assessment of Vocational Education (NAVE), which found that fewer than one-half of all students who both participated in secondary vocational education and received no postsecondary education used their occupationally specific training in their jobs (Boesel et al. 1994). Because occupationally-specific training is of little benefit to students when they do not find related employment, the 1989 NAVE advocated the integration of academic and vocational education so that students would develop broadly applicable academic skills while they were developing their more occupationally-specific skills.

The effective date of the 1990 Perkins Act was July 1, 1991. Data from the 1990 NAEP cannot be used to evaluate the results of this legislation since the assessment preceded the date the legislation went into effect. The NAEP data can, however, provide a useful baseline of the academic achievement of students participating in vocational education before the implementation of the legislation. In fact, because Congress was interested in the academic skills of students participating in vocational education, Section 421(h) of the 1990 Perkins Act mandates that data from NAEP be reported on students participating in vocational education.

While the relationship between vocational education and academic achievement is important, there are other outcomes related to vocational education, such as improved labor market outcomes and persistence in school. Vocational education has been shown to be positively associated with higher wages when students concentrate their course taking in a vocational field and work in their field of concentration (Boesel et al. 1994). Other analyses have indicated that

[1]Roughly three-quarters of students in the HSTS sample have matching NAEP assessment records. See appendix A for a detailed description of the study sample.

greater vocational course taking is associated with lower dropout rates (Rasinski 1994). This report generally documents a negative association between course taking and NAEP achievement, but since the development of academic skills has not traditionally been the goal of vocational education, it would be wrong to draw conclusions about the overall effectiveness of vocational education based on the NAEP data alone.

Since NAEP is a cross-sectional study, causal inferences about the effects of vocational education on academic achievement cannot be drawn. The effects of course taking cannot be disentangled from those of prior achievement or ability, because NAEP only records achievement at a single point in time. Indeed, evidence indicates that vocational course taking in high school is strongly associated with prior academic achievement. In a study of curriculum assignments in three urban comprehensive high schools, researchers found that many vocational education courses were viewed as a "dumping ground" for low ability students and students with behavioral problems (Selvin et al. 1990; Oakes et al. 1992).[2] Detailed analyses of transcript information from these schools revealed a negative association between prior achievement and concentrated vocational course taking. The authors concluded that:

> . . . concentrated vocational education coursetaking was largely, but not entirely, reserved for the least academically able students in the school, as measured by their scores on standardized achievement tests. On average, as achievement scores decreased, the likelihood of taking a concentration of vocational courses increased (Oakes et al. 1992, 60).

The pattern of vocational concentration was also related to characteristics other than prior achievement. The study found that within schools, students of different socioeconomic and racial-ethnic backgrounds but comparable achievement levels varied in the extent to which they concentrated in vocational education, with white students being the most likely to concentrate in vocational education, followed by Hispanic then black students, and Asian students being the least likely to do so. Furthermore, the proportion of relatively high achieving students participating in vocational education decreased during the 1980s (Boesel et al. 1994), so the relationship between vocational education and academic achievement on assessments such as NAEP might be considerably different compared to what it was a decade ago.

In order to draw conclusions about the nature of the relationship between course taking and achievement, researchers and policymakers must use longitudinal data to examine achievement *gains*, with careful controls for other explanatory factors including the availability of different types of courses.[3] Longitudinal data allow researchers to observe the level of student achievement prior to taking particular courses; to measure achievement again after completing the courses; and then to examine how the *change* in achievement is related to differences in course taking. Recent analyses of data from the National Education Longitudinal Study of 1988 (NELS) show that certain academic courses contribute to achievement gains, while vocational courses neither add to nor detract from achievement gains (Rasinski 1994). Rasinski found gains

---

[2]This was found to be especially true for the trade-oriented vocational courses, but not for business courses (Oakes et al. 1992, 60).

[3]For examples of such analyses, see Meyer's work with data from High School and Beyond and Rasinski's current work with data from the National Education Longitudinal Study of 1988 (Meyer 1992; Rasinski 1994).

in mathematics achievement associated with taking algebra I and II, geometry, precalculus, calculus, and physics courses. After controlling for academic course taking, he found no significant relationship between vocational course taking and mathematics achievement gains in the model for all students, but he did find scattered positive and negative relationships for certain types of vocational courses among certain groups of students. Likewise, Meyer found in his analysis of the High School and Beyond sophomore cohort that vocational courses with enriched math content were associated with gains in mathematics achievement, although not as much as mathematics courses that covered the same material (Meyer 1992). These studies document the same patterns between vocational course taking and academic performance that are reported here, but their longitudinal format enabled the researchers to examine the relationship between vocational course taking and achievement *gain* after isolating other factors related to those gains.

Vocational Course Taking and NAEP Assessment Scores[4]

The tables in this report describe the relationship between vocational course taking and NAEP test scores both by presenting the number of vocational credits earned by students in the different NAEP assessment score quartiles (table A), and by examining the average NAEP scores of students who completed varying numbers of credits in vocational education (tables B and C).[5] Both approaches reveal an inverse relationship between the number of credits accumulated in vocational education and NAEP scores. While this report concentrates on the analysis of average NAEP scores at different levels of vocational course taking, appendix A includes detailed tables that allow the interested reader to undertake an examination of credit accumulation by NAEP assessment score quartile.[6]

The Relationship between Measures of Curricular Participation and NAEP Test Scores

Table A displays the average number of vocational, academic, and personal use credits accumulated by students in each quartile of the NAEP mathematics assessment. The data in this table show that students in successively higher score quartiles on the mathematics assessment earned more academic and fewer vocational credits than did students in the lower quartiles. Similar patterns were evident with respect to achievement on the NAEP science and reading assessments.

Table B displays average NAEP mathematics scores for all students by the number of credits completed in vocational education and by other characteristics of their high school curriculum. For all students, mathematics achievement was inversely related to vocational credits, a pattern that was consistent even when other characteristics of their high school programs were similar. In addition, students who earned more academic credits had systematically higher scores on the NAEP mathematics assessment than did students who earned fewer academic credits.

The apparent negative relationship between vocational course taking and NAEP assessment scores could reflect the positive relationship between academic course taking and test scores combined with less academic course taking among students with more vocational credits. There is a practical limit to the total number of courses a student can take while in high school, and while there does not appear to be a one-to-one tradeoff between academic and vocational course taking, analyses of high school course taking have shown that students must choose between the academic and vocational curriculum on the margin (Tuma et al. forthcoming). Thus, because NAEP tests assess skills that are typically developed in academic courses, a plausible explanation

---

[4]Courses were organized for this analysis within the Secondary School Taxonomy (Gifford et al. 1989). Appendix A includes a figure that shows how courses were classified as academic, vocational, or personal use.

[5]Lettered tables are embedded in the text of the report. Because of their size and complexity, the numbered tables referred to in the text appear in appendix B.

[6]The term credit in this publication refers to the equivalent of a 1-year course, or a Carnegie unit.

Table A—Average number of credits earned by public high school graduates in vocational, academic, and personal use courses by NAEP assessment score quartiles: 1990

NAEP assessment and type of credits	NAEP assessment score quartile			
	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Mathematics assessment[1]				
Total credits	23.3	23.4	23.9	24.4
Vocational credits	5.7	4.6	3.2	2.3
Academic credits	14.7	16.0	18.1	19.5
Personal use credits	2.9	2.8	2.6	2.6
Science assessment[2]				
Total credits	23.3	23.4	23.6	24.3
Vocational credits	5.5	4.6	3.4	2.2
Academic credits	15.0	16.0	17.4	19.5
Personal use credits	2.9	2.8	2.7	2.6
Reading assessment[3]				
Total credits	23.3	23.5	23.7	24.2
Vocational credits	5.1	4.4	3.5	2.3
Academic credits	15.2	16.3	17.5	19.3
Personal use credits	3.0	2.8	2.6	2.5

[1]Quartile assessment score ranges are as follows: below 272, 272–296, 297–319, and 320 or higher.
[2]Quartile assessment score ranges are as follows: below 268, 268–293, 294–322, and 323 or higher.
[3]Quartile assessment score ranges are as follows: below 268, 268–291, 292–312, and 313 or higher.

NOTES: Details may not sum to totals due to rounding. For standard errors and unweighted Ns, refer to appendix A, table 19.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

for lower scores among students with high levels of vocational course taking is that they spend less time in the academic courses that develop the skills assessed on NAEP. Another possible explanation for the differences in achievement is that students who perform poorly in junior high school may earn more vocational credits and fewer academic credits in high school than other students.[7]

Table B also includes other aspects of students' high school records that are likely to be related to mathematics achievement, such as overall curricular rigor and the amount and level of mathematics course taking, so it is possible to examine the relationship between vocational course taking and achievement after taking these characteristics into account. There are limitations to this approach. There may be further variation within the categories defined for each measure; these measures do not account for other important aspects of course taking, such as specific content, quality of instruction, or students' mastery of the material. In addition, this approach isolates only one characteristic at a time, rather than simultaneously controlling for all characteristics of interest. Nevertheless, it is desirable to attempt to control for other aspects of students' course taking, and this approach permits finer exploration of the relationship between vocational course taking and achievement. After taking these other characteristics of students'

[7]Both explanations are consistent with findings by Meyer and by Rasinski, who were able to control for prior ability and prior achievement in their analyses of longitudinal data.

Table B—Average NAEP mathematics score for public high school graduates, by vocational credits and curriculum characteristics: 1990

Curriculum characteristics	All students	Vocational credits			Population distribution
		Fewer than 4.0	4.0 to 7.9	8.0 or more	
Total	296.4	308.5	285.4	269.5	100.0
Curricular specialization[1]					
College preparatory	318.5	320.9	308.9	—	32.8
Vocational	276.3	—	281.0	268.4	22.2
All others	290.3	296.7	281.1	268.1	45.1
Compliance with *A Nation at Risk* recommendations[2]					
All requirements	319.4	323.1	308.5	—	15.7
English, math, science, and social studies	307.8	313.4	293.9	—	25.4
English and math[3]	290.2	296.8	286.4	276.0	18.9
English[4]	277.5	286.7	273.6	267.2	14.5
All others	286.4	303.7	279.9	267.4	25.5
Academic credits					
0.00–11.99	264.8	—	269.1	262.9	5.7
12.00–15.99	276.9	280.3	277.2	272.4	29.2
16.00–19.99	301.7	305.1	295.8	—	42.7
20.00 or more	320.0	321.5	301.0	—	22.4
Mathematics credits					
0.00–1.99	266.0	—	264.4	—	3.2
2.00–2.99	276.2	287.1	274.4	266.1	22.6
3.00 or more	303.9	312.3	291.3	276.6	74.2
Highest mathematics course					
Trigonometry or higher[5]	326.0	329.3	314.3	—	33.2
Algebra II	300.1	302.6	296.8	293.3	26.0
Geometry	284.2	287.7	281.3	281.6	14.7
Algebra I	270.0	270.6	269.7	270.0	10.9
Less than algebra I	256.4	257.9	255.5	256.4	15.2

—Not enough cases for a reliable estimate.
[1]Students eligible for both college preparatory and vocational specializations are included in the college preparatory group.
[2]See text for a complete description of category definitions.
[3]Students in this category must also have taken at least two years of science and social studies.
[4]Students in this category must also have taken at least two years of mathematics, science, and social studies.
[5]Precalculus and calculus are also included in this category.

NOTE: For standard errors and unweighted Ns, refer to appendix A, table 1.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

programs into account, the inverse relationship between vocational credits and achievement generally persists.

Table B permits examination of achievement at different levels of exposure to the mathematics curriculum. After taking the number of mathematics courses completed into account, table B shows that mathematics achievement remains inversely related to vocational

course taking among students with 2 or more mathematics credits.[8] With respect to the highest mathematics course taken, however, some interesting differences are evident. Among students who completed algebra II or higher courses, those with more vocational credits tended to score lower on the mathematics assessment. At lower levels of attainment within the mathematics curriculum (geometry or lower), however, achievement and vocational course taking do not appear to be related.

Table B also shows achievement at different levels of compliance with the graduation requirements recommended for all students in the 1983 report of the National Commission on Excellence in Education, *A Nation at Risk*.[9] Figure 1 displays the average NAEP mathematics scores earned by students with varying degrees of compliance with these recommendatons, by the number of vocational credits completed. For the two most rigorous standards, comparisons are limited to students with low and moderate vocational course taking due to the small number of students with 8.0 or more vocational credits. In each of these curriculum categories, students with fewer vocational courses averaged higher mathematics scores. For the remaining curriculum standards, the inverse relationship between vocational course taking and achievement is statistically significant across the three levels of vocational course taking. The inverse relationship between vocational course taking and achievement is evident within the curriculum standards categories for the science and reading assesments as well (tables 2 and 3).

Simple counts of course credits do not capture the full range of educational and curricular experiences. Within categories of credit completion as measured in this report, differences in NAEP scores may also reflect underlying differences in other important aspects of students' education, such as course content, quality of instruction, performance within the courses completed, and student learning.

The Relationship between Demographic Characteristics and NAEP Test Scores

This section examines the relationship between vocational course taking and achievement within demographic subgroups. The analysis parallels that of the previous section, taking students' race-ethnicity and their parents' educational attainment into account. Unfortunately, the sample size of each of the joint assessment-transcript files is relatively small.[10] While the sample is sufficiently large to examine relationships among NAEP test scores, vocational course taking, and one other variable such as academic course taking or parents' education, it is insufficient for complex combinations of factors such as both academic course taking and parents' education.[11]

---

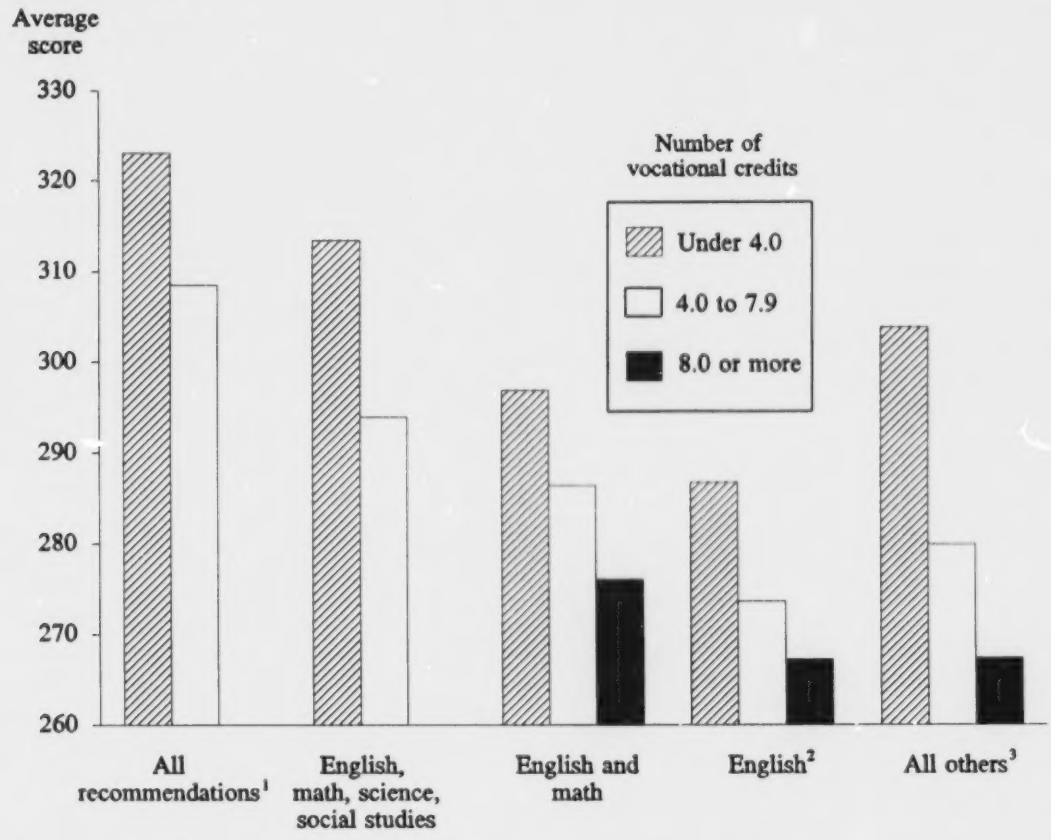
[8]No comparison is possible among those with fewer than 2.00 mathematics credits.

[9]The recommended curriculum call for 4 years of English, 3 years each of mathematics, science, and social studies, 2 years of a single foreign language (recommended for college-bound students), and half a year of computer science (National Commission on Excellence in Education 1983). The categories in table B represent one of many possible ways to structure degrees of compliance with the recommended curriculum; this variable assigns the greatest weight to English, followed by math, and then science and social studies. For further information, refer to appendix A.

[10]Each assessment uses a different sample of students. See appendix A for further information about the joint assessment-transcript samples.

[11]Although the sample size does not permit cross tabulations with complex combinations of variables, it is sufficiently large for regression analysis. However, the NAEP data do not include key variables such as a measure of socioeconomic status that one might include in a regression equation. In addition, multivariate techniques such

Figure 1—Average NAEP mathematics assessment score for public high school graduates, by compliance with *A Nation at Risk* recommendations and number of vocational credits: 1990



NOTE: The average score cannot be estimated for students with 8.0 or more units of vocational courses who met the top two curriculum standards due to the small number of such students in the sample.

[1]The curriculum recommended for all students in *A Nation at Risk* includes 4 years of English, 3 years each of mathematics, science, and social studies, 2 years of a single foreign language, and one half-year of computer science. See text for a complete definition of the measure of compliance with these recommendations.
[2]Students in this category must also have completed at least two years of science and social studies.
[3]Students in this category must also have completed at least two years of mathematics, science, and social studies.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1990 High School Transcript Study and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

When participation in vocational education and academic achievement are examined by race–ethnicity, the same pattern found with the curriculum measures was generally evident: on average, students with more vocational credits had lower mathematics, science, and reading NAEP scores (table C and tables 5 and 6). However, the inverse relationship between vocational

as regression cannot correct for the inherent limitations of cross-sectional data.

Table C—Average NAEP mathematics score for public high school graduates, by vocational credits and selected background characteristics: 1990

Student characteristics	All students	Vocational credits			Population distribution
		Fewer than 4.0	4.0 to 7.9	8.0 or more	
Total	296.4	308.5	285.4	269.5	100.0
Sex					
Male	298.5	310.1	289.9	271.6	48.1
Female	294.6	307.2	281.3	266.6	51.9
Race-ethnicity*					
White, non-Hispanic	302.0	314.1	291.2	272.8	74.4
Black, non-Hispanic	272.1	281.9	265.1	253.0	14.5
Hispanic	279.4	288.2	271.0	—	7.4
Asian/Pacific Islander	316.9	323.9	304.0	—	3.1
Parents' educational attainment					
Less than high school graduate	273.2	282.6	271.1	264.1	7.3
High school graduate	283.0	294.9	277.9	268.8	24.3
Some postsecondary education	297.9	308.1	288.4	270.5	27.7
Bachelor's degree or higher	309.1	316.9	295.7	274.1	40.7

—Not enough cases for a reliable estimate.
*The number of American Indians in the sample is too small for reliable estimates. Population distribution does not sum to 100 percent because American Indians are not included in this table.

NOTE: For standard errors and unweighted Ns, refer to appendix A, table 4.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

course taking and NAEP scores that was generally evident within racial-ethnic groups was not found among blacks for the reading assessment.[12]

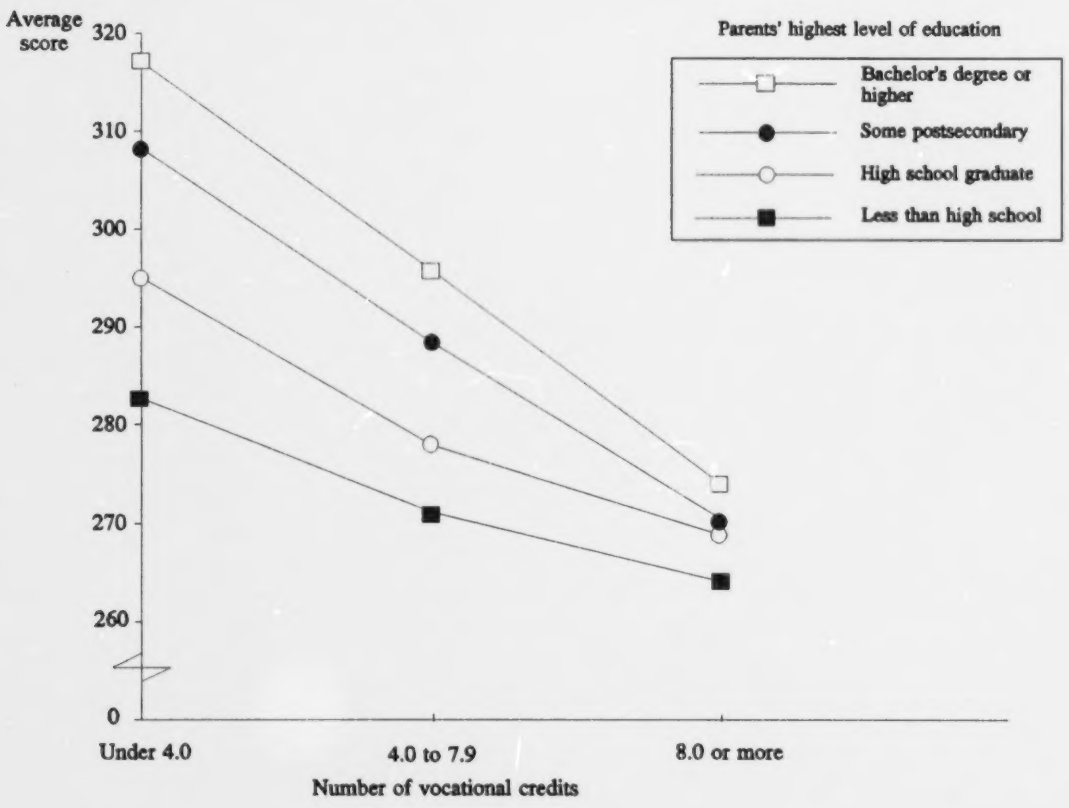
An inverse relationship between vocational credits earned and NAEP test scores was also evident within levels of parents' educational attainment (table C). The same pattern exists for reading and science achievement, except for students whose parents did not complete high school (tables 5 and 6).

Figure 2 displays the average NAEP mathematics scores by parents' highest level of educational attainment and by the number of vocational credits completed. As with the curriculum measures, certain patterns stand out in addition to the negative relationship between vocational course taking and test scores. First, high school graduates with more highly educated parents had higher NAEP scores than did those whose parents had lower levels of education, and this relationship was evident regardless of the number of vocational credits completed. However, the difference in achievement between those students whose parents did not complete high school and those whose parents had at least a bachelor's degree was smaller for students with 8.0 or more vocational credits than for those with fewer than 4.0 vocational credits. This finding calls

[12]Among Hispanics in the math and reading assessments, comparisons are only possible between low and moderate levels of vocational course taking. No comparisons are possible among Asian/Pacific Islanders.

attention to the possibility of other differences that may exist *within* these groups—such as differences in the amount or nature of academic course taking—that are not evident when examining parents' education and vocational course taking in isolation.

Figure 2—Average NAEP mathematics assessment score for public high school graduates, by number of vocational credits and parents' highest level of education: 1990



SOURCE: U.S. Department of Education, National Center for Education Statistics, 1990 High School Transcript Study and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Summary of Findings

This Congressionally-mandated publication provides a baseline for the academic achievement of students taking vocational coursework in 1990, one year prior to the effective date of the 1990 Perkins Act. The report describes associations between variables in the NAEP transcript data. These data do not permit researchers to make causal inferences about how course taking might influence academic achievement, since the NAEP does not measure changes in academic achievement.

Nonetheless, this analysis documents an inverse association between vocational course taking and NAEP assessment scores. The relationship holds for mathematics, science, and reading achievement. The association between vocational course taking and achievement generally persists after attempts are made to take other curriculum characteristics and background characteristics into account, although it attenuates among students whose parents did not complete high school. With respect to mathematics achievement, the inverse relationship between vocational course taking and achievement on the NAEP is evident among students who completed high-level mathematics courses, but is not evident among those who did not complete algebra II or higher level courses.

Despite the consistent finding that vocational course taking is inversely related to achievement on the NAEP tests, this should not be taken as evidence that increased vocational course taking depresses achievement for two reasons. First, this study examines achievement at a single point in time, and does not control for the likelihood that students who initially differ in ability or achievement may also differ in their propensity to enroll in vocational courses. Second, these patterns could reflect what Rasinski found from longitudinal analyses of the NELS data set: certain academic courses contribute to gains in academic test scores, and vocational courses neither enhance nor undermine such growth. Since there is a practical limit on the total number of courses a student can take, the fact that students who take more vocational courses have lower test scores may reflect the reduction in academic courses rather than the addition of vocational courses. In addition, students who earn a large number of vocational credits are less likely to earn credits in advanced academic courses, such as advanced English and calculus (Hoachlander et al. 1990), that are correlated with higher scores.

References

Boesel, D., Hudson, L., Deich, S., and Masten, C. 1994. *Final Report of the National Assessment of Vocational Education, Volume II.* Washington, D.C.: U.S. Department of Education.

Gifford, A., Tuma, J., and Hoachlander, E.G. 1989. *The Secondary School Taxonomy Report.* Washington, D.C.: U.S. Department of Education.

Hoachlander, E.G., Kaufman, P., Levesque, K., and Houser, J. 1990. *Vocational Education in the United States: 1969-1990.* Washington, D.C.: U.S. Department of Education.

Johnson, E.G., and Allen, N.L. 1992. *The NAEP 1990 Technical Report.* Princeton: Educational Testing Service.

Meyer, R. 1992. *Applied Versus Traditional Mathematics: New Econometric Models of the Contribution of High School Courses to Mathematics Proficiency.* Madison: Institute for Research on Poverty, University of Wisconsin-Madison.

National Commission on Excellence in Education. 1983. *A Nation at Risk.* Washington, D.C.: U.S. Department of Education.

Oakes, J., Selvin, M., Karoly, L., and Guiton, G. 1992. *Educational Matchmaking: Academic and Vocational Tracking in Comprehensive High Schools.* Berkeley: National Center for Research in Vocational Education.

Rasinski, K.A. 1994. *The Effect of High School Vocational Education on Academic Achievement Gain and High School Persistence: Evidence from NELS:88 (Draft).* Chicago: National Opinion Research Center.

Selvin, M., Oakes, J., Hare, S., Ramsey, K., and Schoeff, D. 1990. *Who Gets What and Why: Curriculum Decisionmaking at Three Comprehensive High Schools.* Berkeley: National Center for Research in Vocational Education.

Tuma, J., and Burns, S., Forthcoming. *Patterns of Participation in Secondary Vocational Education, 1982-1992.* Washington, D.C.: National Center for Education Statistics, U.S. Department of Education.

Appendix A

Tables

Table 1—Average NAEP mathematics score for public high school graduates, by vocational credits and curriculum characteristics: 1990

Curriculum characteristics	All students	Vocational credits			Population distribution
		Fewer than 4.0	4.0 to 7.9	8.0 or more	
Total	296.4	308.5	285.4	269.5	100.0
(s.e.)	(1.29)	(1.45)	(1.29)	(1.64)	N/A
unweighted Ns	3,061	1,718	1,037	306	3,061
Curricular specialization[1]					
College preparatory	318.5	320.9	308.9	—	32.8
(s.e.)	(1.21)	(1.26)	(2.66)	(—)	(1.99)
unweighted Ns	1,076	883	178	15	1,076
Vocational	276.3	—	281.0	268.4	22.2
(s.e.)	(1.43)	(—)	(1.73)	(1.74)	(1.45)
unweighted Ns	656	16	386	254	656
All others	290.3	296.7	281.1	268.1	45.1
(s.e.)	(2.12)	(2.75)	(1.84)	(5.20)	(1.80)
unweighted Ns	1,329	819	473	37	1,329
Compliance with *A Nation at Risk* recommendations[2]					
All requirements	319.4	323.1	308.5	—	15.7
(s.e.)	(1.98)	(1.85)	(4.22)	(—)	(1.73)
unweighted Ns	483	370	102	11	483
English, math, science, and social studies	307.8	313.4	293.9	—	25.4
(s.e.)	(2.35)	(1.90)	(3.47)	(—)	(1.46)
unweighted Ns	870	644	203	23	870
English and math[3]	290.2	296.8	286.4	276.0	18.9
(s.e.)	(1.87)	(2.54)	(2.22)	(3.60)	(1.31)
unweighted Ns	603	275	272	56	603
English[4]	277.5	286.7	273.6	267.2	14.5
(s.e.)	(1.58)	(2.28)	(1.89)	(2.30)	(1.30)
unweighted Ns	434	163	184	87	434
All others	286.4	303.7	279.9	267.4	25.5
(s.e.)	(4.04)	(6.26)	(2.64)	(2.23)	(2.48)
unweighted Ns	671	266	276	129	671
Academic credits					
0.00–11.99	264.8	—	269.1	262.9	5.7
(s.e.)	(2.27)	(—)	(5.85)	(2.37)	(0.87)
unweighted Ns	145	4	40	101	145
12.00–15.99	276.9	280.3	277.2	272.4	29.2
(s.e.)	(1.63)	(3.85)	(1.66)	(2.05)	(1.39)
unweighted Ns	880	182	521	177	880
16.00–19.99	301.7	305.1	295.8	—	42.7
(s.e.)	(1.48)	(1.73)	(1.80)	(—)	(1.54)
unweighted Ns	1,309	855	431	23	1,309
20.00 or more	320.0	321.5	301.0	—	22.4
(s.e.)	(1.92)	(1.70)	(7.18)	(—)	(1.62)
unweighted Ns	727	677	45	5	727

Table 1—Average NAEP mathematics score for public high school graduates, by vocational credits and curriculum characteristics: 1990—Continued

Curriculum characteristics	All students	Vocational credits			Population distribution
		Fewer than 4.0	4.0 to 7.9	8.0 or more	
Mathematics credits					
0.00–1.99	266.0	—	264.4	—	3.2
(s.e.)	(4.41)	(—)	(7.51)	(—)	(0.63)
unweighted Ns	81	20	37	24	81
2.00–2.99	276.2	287.1	274.4	266.1	22.6
(s.e.)	(1.48)	(2.45)	(1.87)	(1.93)	(1.40)
unweighted Ns	624	201	264	159	624
3.00 or more	303.9	312.3	291.3	276.6	74.2
(s.e.)	(1.58)	(1.50)	(1.63)	(3.29)	(1.35)
unweighted Ns	2,356	1,497	736	123	2,356
Highest mathematics course					
Trigonometry or higher[5]	326.0	329.3	314.3	—	33.2
(s.e.)	(1.49)	(1.33)	(3.31)	(—)	(1.93)
unweighted Ns	1,067	836	219	12	1,067
Algebra II	300.1	302.6	296.8	293.3	26.0
(s.e.)	(0.99)	(1.30)	(1.12)	(3.63)	(1.28)
unweighted Ns	769	467	263	39	769
Geometry	284.2	287.7	281.3	281.6	14.7
(s.e.)	(1.88)	(1.92)	(2.57)	(3.30)	(1.20)
unweighted Ns	472	216	206	50	472
Algebra I	270.0	270.6	269.7	270.0	10.9
(s.e.)	(1.45)	(3.09)	(2.02)	(2.22)	(0.92)
unweighted Ns	317	90	157	70	317
Less than algebra I	256.4	257.9	255.5	256.4	15.2
(s.e.)	(1.32)	(2.59)	(2.00)	(2.04)	(0.90)
unweighted Ns	436	109	192	135	436

N/A Not applicable.
—Not enough cases for a reliable estimate.
[1]Students eligible for both college preparatory and vocational applications are included in the college preparatory group.
[2]See text for a complete description of category definitions.
[3]Students in this category must also have taken at least two years of science and social studies.
[4]Students in this category must also have taken at least two years of mathematics, science, and social studies.
[5]Precalculus and calculus are also included in this category.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 2—Average NAEP science score for public high school graduates, by vocational credits and curriculum characteristics: 1990

Curriculum characteristics	All students	Vocational credits			Population distribution
		Fewer than 4.0	4.0 to 7.9	8.0 or more	
Total	295.0	309.1	281.2	265.9	100.0
(s.e.)	(1.56)	(1.95)	(1.74)	(2.55)	N/A
unweighted Ns	3,123	1,732	1,069	322	3,123
Curricular specialization[1]					
College preparatory	319.5	323.1	303.3	—	31.5
(s.e.)	(2.17)	(2.01)	(5.18)	(--)	(1.74)
unweighted Ns	1,080	884	188	8	1,080
Vocational	273.6	—	277.9	267.4	22.8
(s.e.)	(2.22)	(—)	(2.52)	(2.91)	(1.17)
unweighted Ns	697	17	405	275	697
All others	288.7	297.0	276.5	251.9	45.7
(s.e.)	(2.48)	(3.31)	(2.03)	(5.68)	(1.84)
unweighted Ns	1,346	831	476	39	1,346
Compliance with *A Nation at Risk* recommendations[2]					
All requirements	318.6	324.3	301.1	—	13.2
(s.e.)	(3.28)	(2.52)	(6.19)	(—)	(1.37)
unweighted Ns	448	333	111	4	448
English, math, science, and social studies	309.6	316.6	290.9	270.8	26.4
(s.e.)	(2.42)	(2.16)	(3.92)	(7.45)	(1.38)
unweighted Ns	905	671	201	33	905
English and math[3]	285.1	291.9	279.7	271.3	20.5
(s.e.)	(2.37)	(3.00)	(3.36)	(4.79)	(1.21)
unweighted Ns	660	321	268	71	660
English[4]	278.4	289.3	275.0	264.3	14.2
(s.e.)	(1.78)	(2.65)	(2.66)	(4.63)	(1.16)
unweighted Ns	429	137	228	64	429
All others	284.8	306.5	275.6	263.9	25.8
(s.e.)	(4.81)	(7.63)	(3.04)	(3.62)	(2.70)
unweighted Ns	681	270	261	150	681
Academic credits					
0.00–11.99	259.8	—	257.7	260.6	6.1
(s.e.)	(4.35)	(—)	(5.54)	(4.94)	(0.82)
unweighted Ns	161	7	54	100	161
12.00–15.99	275.8	285.2	275.6	267.5	31.2
(s.e.)	(2.10)	(5.36)	(2.13)	(2.75)	(1.56)
unweighted Ns	946	178	569	199	946
16.00–19.99	300.0	303.2	293.1	—	39.8
(s.e.)	(1.87)	(2.14)	(3.24)	(—)	(1.19)
unweighted Ns	1,269	857	392	20	1,269
20.00 or more	321.8	324.0	293.8	—	22.9
(s.e.)	(2.89)	(2.50)	(10.35)	(—)	(1.51)
unweighted Ns	747	690	54	3	747

N/A Not applicable.
—Not enough cases for a reliable estimate.
[1]Students eligible for both college preparatory and vocational concentrator are included in the college preparatory group.
[2]See text for a complete description of category definitions.
[3]Students in this category must also have taken at least two years of science and social studies.
[4]Students in this category must also have taken at least two years of mathematics, science, and social studies.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 3—Average NAEP reading score for public high school graduates, by vocational credits and curriculum characteristics: 1990

Curriculum characteristics	All students	Vocational credits			Population distribution
		Fewer than 4.0	4.0 to 7.9	8.0 or more	
Total	289.5	299.3	280.0	269.4	100.0
(s.e.)	(1.43)	(1.78)	(1.41)	(2.16)	N/A
unweighted Ns	3,106	1,716	1,106	284	3,106
Curricular specialization[1]					
College preparatory	306.3	308.4	297.3	—	32.2
(s.e.)	(1.94)	(1.69)	(4.07)	(—)	(1.74)
unweighted Ns	1,086	872	212	2	1,086
Vocational	274.6	287.6	276.7	269.9	24.1
(s.e.)	(1.50)	(7.33)	(1.73)	(2.25)	(1.40)
unweighted Ns	715	24	446	245	715
All others	285.3	290.9	276.4	265.1	43.7
(s.e.)	(2.14)	(2.90)	(1.67)	(4.40)	(1.92)
unweighted Ns	1,305	820	448	37	1,305
Compliance with *A Nation at Risk* recommendations[2]					
All requirements	305.8	308.6	297.8	—	14.0
(s.e.)	(2.47)	(2.46)	(4.48)	(—)	(1.45)
unweighted Ns	466	340	124	2	466
English, math, science, and social studies	297.0	301.1	285.6	—	26.4
(s.e.)	(2.77)	(2.93)	(3.43)	(—)	(1.45)
unweighted Ns	884	643	216	25	884
English and math[3]	285.0	293.1	279.5	268.3	18.8
(s.e.)	(2.02)	(1.94)	(2.81)	(7.33)	(1.40)
unweighted Ns	624	298	270	56	624
English[4]	277.8	283.9	275.3	271.9	15.8
(s.e.)	(1.59)	(3.43)	(1.81)	(2.53)	(1.38)
unweighted Ns	473	167	222	84	473
All others	293.3	300.3	274.4	267.0	25.0
(s.e.)	(3.30)	(5.16)	(2.23)	(2.55)	(2.91)
unweighted Ns	659	268	274	117	659
Academic credits					
0.00–11.99	268.4	—	268.4	266.7	5.9
(s.e.)	(2.42)	(—)	(4.41)	(3.27)	(0.72)
unweighted Ns	146	6	52	88	146
12.00–15.99	274.3	279.6	275.9	270.5	29.6
(s.e.)	(1.55)	(4.18)	(1.64)	(2.97)	(1.34)
unweighted Ns	892	156	561	175	892
16.00–19.99	292.0	294.1	288.2	—	41.9
(s.e.)	(2.10)	(2.56)	(2.82)	(—)	(1.48)
unweighted Ns	1,334	870	449	15	1,334
20.00 or more	310.2	311.1	299.9	—	22.6
(s.e.)	(1.80)	(1.77)	(5.46)	(—)	(1.47)
unweighted Ns	734	684	44	6	734

N/A Not applicable.
—Not enough cases for a reliable estimate.
[1]Students eligible for both college preparatory and vocational specializations are included in the college preparatory group.
[2]See text for a complete description of category definitions.
[3]Students in this category must also have taken at least two years of science and social studies.
[4]Students in this category must also have taken at least two years of mathematics, science, and social studies.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

BEST COPY AVAILABLE

Table 4—Average NAEP mathematics score for public high school graduates, by vocational credits and selected background characteristics: 1990

Student characteristics	All students	Vocational credits			Population distribution
		Fewer than 4.0	4.0 to 7.9	8.0 or more	
Total	296.4	308.5	285.4	269.5	100.0
(s.e.)	(1.29)	(1.45)	(1.29)	(1.64)	N/A
unweighted Ns	3,061	1,718	1,037	306	3,061
Sex					
Male	298.5	310.1	289.9	271.6	48.1
(s.e.)	(1.53)	(1.80)	(1.45)	(2.00)	(0.92)
unweighted Ns	1,445	793	488	164	1,445
Female	294.6	307.2	281.3	266.6	51.9
(s.e.)	(1.43)	(1.56)	(1.79)	(2.49)	(0.92)
unweighted Ns	1,616	925	549	142	1,616
Race-ethnicity*					
White, non-Hispanic	302.0	314.1	291.2	272.8	74.4
(s.e.)	(1.30)	(1.51)	(1.27)	(1.83)	(0.63)
unweighted Ns	2,236	1,286	711	239	2,236
Black, non-Hispanic	272.1	281.9	265.1	253.0	14.5
(s.e.)	(2.01)	(2.37)	(2.78)	(4.95)	(0.52)
unweighted Ns	440	216	184	40	440
Hispanic	279.4	288.2	271.0	—	7.4
(s.e.)	(2.92)	(3.47)	(3.56)	(—)	(0.46)
unweighted Ns	255	133	96	26	255
Asian/Pacific Islander	316.9	323.9	304.0	—	3.1
(s.e.)	(5.51)	(4.23)	(5.39)	(—)	(0.32)
unweighted Ns	108	74	34	0	108
Parents' educational attainment					
Less than high school graduate	273.2	282.6	271.1	264.1	7.3
(s.e.)	(2.42)	(3.92)	(2.90)	(4.72)	(0.76)
unweighted Ns	244	80	114	50	244
High school graduate	283.0	294.9	277.9	268.8	24.3
(s.e.)	(1.68)	(2.60)	(1.92)	(2.14)	(1.13)
unweighted Ns	708	290	303	115	708
Some postsecondary education	297.9	308.1	288.4	270.5	27.7
(s.e.)	(1.15)	(1.76)	(1.69)	(3.13)	(0.91)
unweighted Ns	831	470	297	64	831
Bachelor's degree or higher	309.1	316.9	295.7	274.1	40.7
(s.e.)	(1.62)	(1.79)	(1.99)	(2.65)	(1.28)
unweighted Ns	1,210	849	299	62	1,210

N/A Not applicable.
—Not enough cases for a reliable estimate.
*The number of American Indians in the sample is too small for reliable estimates. Population distribution does not sum to 100 percent because American Indians are not included in this table.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 5—Average NAEP science score for public high school graduates, by vocational credits and selected background characteristics: 1990

Student characteristics	All students	Vocational credits			Population distribution
		Fewer than 4.0	4.0 to 7.9	8.0 or more	
Total	295.0	309.1	281.2	265.9	100.0
(s.e.)	(1.56)	(1.95)	(1.74)	(2.55)	N/A
unweighted Ns	3,123	1,732	1,069	322	3,123
Sex					
Male	300.2	316.0	286.1	268.8	46.5
(s.e.)	(1.80)	(2.32)	(2.17)	(2.81)	(1.11)
unweighted Ns	1,442	790	488	164	1,442
Female	290.4	303.3	276.9	263.0	53.5
(s.e.)	(1.67)	(2.15)	(2.07)	(3.70)	(1.11)
unweighted Ns	1,681	942	581	158	1,681
Race-ethnicity*					
White, non-Hispanic	302.7	317.0	288.9	271.7	73.2
(s.e.)	(1.59)	(1.74)	(1.86)	(2.95)	(0.85)
unweighted Ns	2,208	1,233	735	240	2,208
Black, non-Hispanic	262.1	272.6	252.9	243.2	14.1
(s.e.)	(2.42)	(3.43)	(3.35)	(5.36)	(0.66)
unweighted Ns	409	198	167	44	409
Hispanic	277.0	290.3	265.6	251.9	8.1
(s.e.)	(3.33)	(4.62)	(4.19)	(6.31)	(0.42)
unweighted Ns	318	173	114	31	318
Asian/Pacific Islander	309.4	321.2	285.1	—	3.8
(s.e.)	(10.62)	(9.16)	(9.24)	(—)	(0.34)
unweighted Ns	154	114	36	4	154
Parents' educational attainment					
Less than high school graduate	270.7	282.3	270.1	260.2	7.6
(s.e.)	(3.82)	(5.93)	(4.50)	(5.72)	(0.83)
unweighted Ns	251	84	106	61	251
High school graduate	279.8	291.4	276.0	266.0	23.6
(s.e.)	(1.85)	(3.16)	(2.61)	(3.61)	(0.95)
unweighted Ns	726	271	335	120	726
Some postsecondary education	296.1	306.7	283.2	274.0	28.5
(s.e.)	(1.79)	(2.12)	(2.52)	(4.29)	(1.10)
unweighted Ns	846	486	290	70	846
Bachelor's degree or higher	310.3	318.9	291.6	274.6	40.3
(s.e.)	(1.74)	(2.15)	(2.61)	(5.19)	(1.77)
unweighted Ns	1,227	863	308	56	1,227

N/A Not applicable.
—Not enough cases for a reliable estimate.
*The number of American Indians in the sample is too small for reliable estimates. Population distribution does not sum to 100 percent because American Indians are not included in this table.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 6—Average NAEP reading score for public high school graduates, by vocational credits and selected background characteristics: 1990

Student characteristics	All students	Vocational credits			Population distribution
		Fewer than 4.0	4.0 to 7.9	8.0 or more	
Total	289.5	299.3	280.0	269.4	100.0
(s.e.)	(1.43)	(1.78)	(1.41)	(2.16)	N/A
unweighted Ns	3,106	1,716	1,106	284	3,106
Sex					
Male	284.8	294.6	276.5	264.5	48.0
(s.e.)	(1.79)	(2.35)	(1.74)	(3.02)	(0.95)
unweighted Ns	1,462	788	529	145	1,462
Female	293.8	303.4	283.4	274.4	52.0
(s.e.)	(1.39)	(1.63)	(1.54)	(3.08)	(0.95)
unweighted Ns	1,644	928	577	139	1,644
Race–ethnicity*					
White, non-Hispanic	294.3	304.9	284.6	270.0	75.1
(s.e.)	(1.34)	(1.55)	(1.51)	(2.00)	(0.98)
unweighted Ns	2,256	1,249	775	232	2,256
Black, non-Hispanic	271.1	276.2	265.7	271.8	13.9
(s.e.)	(2.72)	(4.89)	(2.76)	(3.99)	(0.91)
unweighted Ns	400	184	182	34	400
Hispanic	275.1	282.9	268.2	—	7.2
(s.e.)	(3.56)	(4.43)	(4.20)	(—)	(0.41)
unweighted Ns	288	159	112	17	288
Asian/Pacific Islander	289.7	291.7	—	—	3.2
(s.e.)	(5.08)	(5.70)	(—)	(—)	(0.28)
unweighted Ns	138	110	27	1	138
Parents' educational attainment					
Less than high school graduate	273.0	279.2	270.2	270.2	7.4
(s.e.)	(2.09)	(4.49)	(2.60)	(4.20)	(0.64)
unweighted Ns	257	89	119	49	257
High school graduate	280.5	289.6	276.8	269.4	24.8
(s.e.)	(1.65)	(2.85)	(1.74)	(3.24)	(1.10)
unweighted Ns	737	288	339	110	737
Some postsecondary education	292.9	301.5	284.9	271.7	26.5
(s.e.)	(1.66)	(1.87)	(1.87)	(3.70)	(1.29)
unweighted Ns	805	451	299	55	805
Bachelor's degree or higher	297.1	303.9	283.7	271.0	41.3
(s.e.)	(1.82)	(2.14)	(2.56)	(4.43)	(1.65)
unweighted Ns	1,239	866	316	57	1,239

N/A Not applicable.
—Not enough cases for a reliable estimate.
*The number of American Indians in the sample is too small for reliable estimates. Population distribution does not sum to 100 percent because American Indians are not included in this table.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 7—Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP mathematics assessment score quartiles and curriculum characteristics: 1990

Curriculum characteristics	Credits in vocational courses					Credits in academic courses					Credits in personal use courses				
		NAEP score quartile					NAEP score quartile					NAEP score quartile			
	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Total	3.9	5.7	4.6	3.2	2.3	17.1	14.7	16.0	18.1	19.5	2.7	2.9	2.8	2.6	2.6
(s.e.)	(0.11)	(0.17)	(0.16)	(0.15)	(0.09)	(0.16)	(0.25)	(0.19)	(0.19)	(0.16)	(0.08)	(0.10)	(0.09)	(0.10)	(0.10)
unweighted Ns	3,061	776	727	780	778	3,061	776	727	780	778	3,061	776	727	780	778
Curricular specialization[1]															
College preparatory	2.4	4.10	2.9	2.4	2.1	19.7	18.4	18.9	19.6	20.2	2.5	2.9	2.9	2.4	2.5
(s.e.)	(0.12)	(0.46)	(0.29)	(0.15)	(0.10)	(0.14)	(0.47)	(0.21)	(0.19)	(0.14)	(0.10)	(0.20)	(0.10)	(0.13)	(0.11)
unweighted Ns	1,076	36	163	358	519	1,076	36	163	358	519	1,076	36	163	358	519
Vocational	7.3	7.9	7.2	6.6	5.7	13.8	13.2	13.7	15.3	16.1	2.4	2.4	2.4	2.3	2.3
(s.e.)	(0.16)	(0.21)	(0.21)	(0.26)	(0.27)	(0.13)	(0.20)	(0.17)	(0.36)	(0.33)	(0.10)	(0.13)	(0.11)	(0.13)	(0.14)
unweighted Ns	656	318	209	96	33	656	318	209	96	33	656	318	209	96	33
All others	3.4	4.2	3.7	2.8	2.3	16.7	15.5	16.2	17.5	18.6	3.1	3.3	3.1	3.0	2.8
(s.e.)	(0.11)	(0.15)	(0.14)	(0.15)	(0.16)	(0.19)	(0.29)	(0.21)	(0.25)	(0.38)	(0.09)	(0.13)	(0.11)	(0.13)	(0.16)
unweighted Ns	1,329	422	355	326	226	1,329	422	355	326	226	1,329	422	355	326	226
Compliance with *A Nation at Risk* recommendations[2]															
All requirements	2.8	—	3.4	2.8	2.4	19.7	—	18.4	19.4	20.3	2.5	—	3.1	2.4	2.4
(s.e.)	(0.17)	(—)	(0.34)	(0.17)	(0.15)	(0.16)	(—)	(0.29)	(0.19)	(0.19)	(0.12)	(—)	(0.20)	(0.15)	(0.12)
unweighted Ns	483	18	64	156	245	483	18	64	156	245	483	18	64	156	245
English, math, science, and social studies	2.7	4.7	3.1	2.6	2.0	19.1	17.7	18.4	19.1	20.0	2.7	3.3	2.9	2.5	2.6
(s.e.)	(0.17)	(0.49)	(0.27)	(0.22)	(0.10)	(0.20)	(1.03)	(0.20)	(0.24)	(0.15)	(0.11)	(0.20)	(0.15)	(0.13)	(0.12)
unweighted Ns	870	123	174	270	303	870	123	174	270	303	870	123	174	270	303
English and math[3]	4.2	5.1	4.6	3.5	3.2	16.5	15.4	16.0	17.4	17.8	2.9	2.9	2.9	3.0	2.6
(s.e.)	(0.18)	(0.26)	(0.28)	(0.24)	(0.22)	(0.23)	(0.26)	(0.28)	(0.38)	(0.30)	(0.11)	(0.15)	(0.13)	(0.18)	(0.22)
unweighted Ns	603	179	174	156	94	603	179	174	156	94	603	179	174	156	94
English[4]	5.0	5.6	5.2	3.6	—	15.4	14.4	15.2	17.5	—	2.7	2.9	2.6	2.5	—
(s.e.)	(0.18)	(0.19)	(0.26)	(0.38)	(—)	(0.19)	(0.20)	(0.19)	(0.46)	(—)	(0.13)	(0.14)	(0.19)	(0.17)	(—)
unweighted Ns	434	205	138	75	16	434	205	138	75	16	434	205	138	75	16
All others	5.1	6.5	5.5	4.2	2.2	14.8	13.1	14.1	16.0	18.5	2.8	2.8	2.8	2.8	2.9
(s.e.)	(0.29)	(0.28)	(0.27)	(0.32)	(0.27)	(0.33)	(0.24)	(0.29)	(0.40)	(0.74)	(0.12)	(0.19)	(0.14)	(0.17)	(0.20)
unweighted Ns	671	251	177	123	120	671	251	177	123	120	671	251	177	123	120

Table 7—Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP mathematics assessment score quartiles and curriculum characteristics: 1990—Continued

Curriculum characteristics	Credits in vocational courses					Credits in academic courses					Credits in personal use courses				
		NAEP score quartile					NAEP score quartile					NAEP score quartile			
	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Academic credits															
0.00–11.99	8.8	9.1	8.2	—	—	10.5	10.4	10.6	—	—	2.5	2.6	2.4	—	—
(s.e.)	(0.29)	(0.32)	(0.48)	(—)	(—)	(0.10)	(0.10)	(0.16)	(—)	(—)	(0.20)	(0.27)	(0.24)	(—)	(—)
unweighted Ns	145	96	37	9	3	145	96	37	9	3	145	96	37	9	3
12.00–15.99	5.8	6.0	5.9	5.2	4.7	14.0	13.8	13.9	14.3	14.8	3.0	3.0	3.0	3.1	3.0
(s.e.)	(0.13)	(0.16)	(0.19)	(0.30)	(0.37)	(0.04)	(0.07)	(0.08)	(0.08)	(0.09)	(0.10)	(0.12)	(0.12)	(0.19)	(0.21)
unweighted Ns	880	416	288	142	34	880	416	288	142	34	880	416	288	142	34
16.00–19.99	3.3	3.8	3.4	3.2	2.8	17.7	17.3	17.4	17.8	18.1	2.8	3.0	2.8	2.7	2.7
(s.e.)	(0.11)	(0.20)	(0.16)	(0.15)	(0.11)	(0.03)	(0.08)	(0.07)	(0.06)	(0.08)	(0.10)	(0.12)	(0.11)	(0.12)	(0.13)
unweighted Ns	1,309	230	308	407	364	1,309	230	308	407	364	1,309	230	308	407	364
20.00 or more	1.6	4.1	1.8	1.5	1.5	21.6	23.0	21.2	21.7	21.6	2.4	3.3	2.5	2.2	2.4
(s.e.)	(0.13)	(1.58)	(0.18)	(0.11)	(0.08)	(0.14)	(2.41)	(0.17)	(0.13)	(0.10)	(0.11)	(0.47)	(0.14)	(0.12)	0.12)
unweighted Ns	727	34	94	222	377	727	34	94	222	377	727	34	94	222	377
Vocational credits															
0.00–3.99	1.9	2.5	2.2	1.9	1.7	18.9	16.7	17.8	19.2	20.0	2.9	3.5	3.2	2.7	2.6
(s.e.)	(0.05)	(0.06)	(0.06)	(0.07)	(0.06)	(0.14)	(0.25)	(0.16)	(0.20)	(0.16)	(0.10)	(0.13)	(0.11)	(0.14)	(0.11)
unweighted Ns	1,718	221	328	532	637	1,718	221	328	532	637	1,718	221	328	532	637
4.00–7.99	5.4	5.7	5.5	5.2	4.9	15.5	14.6	15.2	16.3	17.3	2.7	2.9	2.7	2.5	2.5
(s.e.)	(0.04)	(0.06)	(0.07)	(0.08)	(0.09)	(0.18)	(0.22)	(0.24)	(0.24)	(0.23)	(0.10)	(0.14)	(0.11)	(0.13)	(0.14)
unweighted Ns	1,037	382	302	217	136	1,037	382	302	217	136	1,037	382	302	217	136
8.00 or more	9.6	9.8	9.3	9.5	—	12.6	12.4	12.6	13.5	—	2.1	2.2	2.1	2.1	—
(s.e.)	(0.13)	(0.19)	(0.13)	(0.37)	(—)	(0.33)	(0.51)	(0.29)	(0.35)	(—)	(0.12)	(0.16)	(0.13)	(0.21)	(—)
unweighted Ns	306	173	97	31	5	306	173	97	31	5	306	173	97	31	5
Mathematics credits															
0.00–1.99	6.2	6.5	—	—	—	12.5	12.3	—	—	—	2.8	2.8	—	—	—
(s.e.)	(0.63)	(0.75)	(—)	(—)	(—)	(0.65)	(0.70)	(—)	(—)	(—)	(0.27)	(0.39)	(—)	(—)	(—)
unweighted Ns	81	49	25	6	1	81	49	25	6	1	81	49	25	6	1
2.00–2.99	5.6	6.4	5.5	4.1	—	14.5	13.5	14.5	16.3	—	2.6	2.7	2.7	2.6	—
(s.e.)	(0.18)	(0.27)	(0.21)	(0.36)	(—)	(0.17)	(0.18)	(0.19)	(0.43)	(—)	(0.12)	(0.15)	(0.15)	(0.14)	(—)
unweighted Ns	624	303	200	94	27	624	303	200	94	27	624	303	200	94	27
3.00 or more	3.4	5.0	4.1	3.0	2.38	18.1	16.1	16.9	18.4	19.6	2.8	3.1	2.9	2.7	2.6
(s.e.)	(0.13)	(0.21)	(0.18)	(0.15)	(0.10)	(0.16)	(0.35)	(0.19)	(0.18)	(0.16)	(0.08)	(0.13)	(0.08)	(0.11)	(0.11)
unweighted Ns	2356	424	502	680	750	2356	424	502	680	750	2356	424	502	680	750

Table 7—Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP mathematics assessment score quartiles and curriculum characteristics: 1990—Continued

Curriculum characteristics	Credits in vocational courses					Credits in academic courses					Credits in personal use courses				
		NAEP score quartile					NAEP score quartile					NAEP score quartile			
	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Highest mathematics course															
Trigonometry or higher[5]	2.5	4.8	3.3	2.7	2.2	19.4	16.2	18.3	19.1	19.8	2.6	2.5	2.9	2.6	2.6
(s.e.)	(0.11)	(0.39)	(0.30)	(0.21)	(0.10)	(0.20)	(0.52)	(0.39)	(0.28)	(0.19)	(0.11)	(0.52)	(0.20)	(0.14)	(0.11)
unweighted Ns	1067	40	73	286	668	1067	40	73	286	668	1067	40	73	286	668
Algebra II	3.6	4.7	4.1	3.2	2.9	17.6	17.0	16.9	18.0	18.1	2.8	3.5	2.9	2.7	2.4
(s.e.)	(0.13)	(0.58)	(0.20)	(0.14)	(0.21)	(0.21)	(1.16)	(0.25)	(0.21)	(0.31)	(0.09)	(0.23)	(0.11)	(0.09)	(0.12)
unweighted Ns	769	62	252	364	91	769	62	252	364	91	769	62	252	364	91
Geometry	4.3	4.8	4.4	3.8	—	16.0	15.6	15.8	16.4	—	2.8	2.9	2.8	2.7	—
(s.e.)	(0.17)	(0.27)	(0.23)	(0.28)	(—)	(0.20)	(0.31)	(0.25)	(0.33)	(—)	(0.13)	(0.17)	(0.14)	(0.23)	(—)
unweighted Ns	472	132	219	105	16	472	132	219	105	16	472	132	219	105	16
Algebra I	5.5	5.5	5.7	—	—	15.1	15.3	14.5	—	—	2.7	2.8	2.7	—	—
(s.e.)	(0.21)	(0.26)	(0.26)	(—)	(—)	(0.25)	(0.34)	(0.33)	(—)	(—)	(0.10)	(0.14)	(0.14)	(—)	(—)
unweighted Ns	317	184	110	21	2	317	184	110	21	2	317	184	110	21	2
Less than algebra I	6.3	6.3	3.0	—	—	13.6	13.6	13.5	—	—	2.9	2.9	2.7	—	—
(s.e.)	(0.21)	(0.22)	(0.33)	(—)	(—)	(0.22)	(0.23)	(0.33)	(—)	(—)	(0.14)	(0.15)	(0.18)	(—)	(—)
unweighted Ns	436	358	73	4	1	436	358	73	4	1	436	358	73	4	1

—Not enough cases for a reliable estimate.
[1]Students eligible for both college preparatory and vocational specializations are included in the college preparatory group.
[2]See text for a complete description of category definitions.
[3]Students in this category must also have taken at least two years of science and social studies.
[4]Students in this category must also have taken at least two years of mathematics, science, and social studies.
[5]Precalculus and calculus are also included in this category.

NOTE: Quartile assessment score ranges are as follows: below 272, 272–296, 297–319, and 320 or higher.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 8—Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP science assessment score quartiles and curriculum characteristics: 1990

Curriculum characteristics	Credits in vocational courses					Credits in academic courses					Credits in personal use courses				
		NAEP score quartile					NAEP score quartile					NAEP score quartile			
	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Total	3.9	5.5	4.6	3.4	2.2	17.0	15.0	16.0	17.4	19.5	2.7	2.9	2.8	2.7	2.6
(s.e.)	(0.11)	(0.17)	(0.13)	(0.12)	(0.10)	(0.14)	(0.20)	(0.18)	(0.16)	(0.15)	(0.08)	(0.09)	(0.11)	(0.08)	(0.10)
unweighted	3,123	822	751	774	776	3,123	822	751	774	776	3,123	822	751	774	776
Curricular specialization[1]															
College preparatory	2.3	3.3	2.9	2.4	1.8	19.9	18.7	19.4	19.4	20.5	2.6	2.9	2.7	2.6	2.5
(s.e.)	(0.11)	(0.42)	(0.20)	(0.17)	(0.09)	(0.12)	(0.33)	(0.24)	(0.19)	(0.13)	(0.09)	(0.16)	(0.14)	(0.13)	(0.10)
unweighted Ns	1,080	79	177	328	496	1,080	79	177	328	496	1,080	79	177	328	496
Vocational	7.4	7.8	7.4	6.8	6.1	13.6	13.0	13.6	14.2	15.4	2.5	2.5	2.5	2.5	2.3
(s.e.)	(0.15)	(0.25)	(0.17)	(0.17)	(0.20)	(0.14)	(0.19)	(0.20)	(0.25)	(0.21)	(0.09)	(0.09)	(0.13)	(0.13)	(0.14)
unweighted Ns	697	311	226	118	42	697	311	226	118	42	697	311	226	118	42
All others	3.3	4.2	3.5	3.1	2.1	16.8	15.8	16.2	17.0	18.6	3.0	3.1	3.0	2.9	2.8
(s.e.)	(0.12)	(0.17)	(0.14)	(0.13)	(0.17)	(0.20)	(0.26)	(0.18)	(0.23)	(0.37)	(0.09)	(0.11)	(0.14)	(0.09)	(0.15)
unweighted Ns	1,346	432	348	328	238	1,346	432	348	328	238	1,346	432	348	328	238
Compliance with *A Nation at Risk* recommendations[2]															
All requirements	2.7	4.4	3.2	2.8	2.3	19.7	19.0	19.4	19.2	20.2	2.5	2.5	2.5	2.6	2.5
(s.e.)	(0.14)	(0.30)	(0.25)	(0.21)	(0.12)	(0.16)	(0.76)	(0.32)	(0.19)	(0.18)	(0.11)	(0.18)	(0.16)	(0.15)	(0.12)
unweighted Ns	448	33	77	137	201	448	33	77	137	201	448	33	77	137	201
English, math, science, and social studies	2.6	4.0	3.3	2.5	1.8	19.2	17.7	18.4	19.1	20.2	2.7	3.1	2.9	2.6	2.6
(s.e.)	(0.15)	(0.32)	(0.27)	(0.17)	(0.09)	(0.14)	(0.41)	(0.23)	(0.17)	(0.13)	(0.10)	(0.17)	(0.16)	(0.12)	(0.11)
unweighted Ns	905	149	174	239	343	905	149	174	239	343	905	149	174	239	343
English and math[3]	4.2	4.7	4.7	3.8	2.5	16.5	15.6	16.1	16.9	18.3	2.9	2.9	2.9	2.9	2.7
(s.e.)	(0.19)	(0.23)	(0.29)	(0.25)	(0.22)	(0.19)	(0.25)	(0.25)	(0.27)	(0.31)	(0.11)	(0.18)	(0.14)	(0.13)	(0.25)
unweighted Ns	660	218	198	163	81	660	218	198	163	81	660	218	198	163	81
English[4]	5.0	5.9	5.0	3.7	4.4	15.2	14.5	15.1	16.3	16.1	2.8	2.8	2.8	2.6	2.5
(s.e.)	(0.17)	(0.31)	(0.19)	(0.32)	(0.39)	(0.16)	(0.26)	(0.19)	(0.36)	(0.43)	(0.14)	(0.15)	(0.19)	(0.17)	(0.36)
unweighted Ns	429	169	140	86	34	429	169	140	86	34	429	169	140	86	34
All others	5.1	6.6	5.7	4.4	2.1	14.8	13.3	13.7	15.5	18.6	2.8	2.8	2.7	2.7	2.8
(s.e.)	(0.33)	(0.31)	(0.29)	(0.26)	(0.36)	(0.42)	(0.30)	(0.34)	(0.41)	(0.76)	(0.10)	(0.11)	(0.17)	(0.17)	(0.14)
unweighted Ns	681	253	162	149	117	681	253	162	149	117	681	253	162	149	117

Table 8—Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP science assessment score quartiles and curriculum characteristics: 1990—Continued

Curriculum characteristics	Credits in vocational courses					Credits in academic courses					Credits in personal use courses				
		NAEP score quartile					NAEP score quartile					NAEP score quartile			
	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Academic credits															
0.00–11.99	8.2	8.4	8.0	—	—	10.4	10.2	10.6	—	—	2.7	2.8	2.6	—	—
(s.e.)	(0.32)	(0.37)	(0.38)	(—)	(—)	(0.08)	(0.14)	(0.10)	(—)	(—)	(0.13)	(0.18)	(0.27)	(—)	(—)
unweighted Ns	161	93	47	17	4	161	93	47	17	4	161	93	47	17	4
12.00–15.99	5.9	6.3	5.9	5.3	4.6	14.0	13.8	14.0	14.2	14.5	3.0	2.9	3.0	2.9	3.2
(s.e.)	(0.15)	(0.22)	(0.15)	(0.23)	(0.42)	(0.05)	(0.08)	(0.08)	(0.11)	(0.15)	(0.10)	(0.10)	(0.13)	(0.15)	(0.26)
unweighted Ns	946	399	302	191	54	946	399	302	191	54	946	399	302	191	54
16.00–19.99	3.0	3.5	3.3	3.1	2.6	17.8	17.5	17.5	17.8	18.1	2.8	2.8	2.8	2.7	2.8
(s.e.)	(0.11)	(0.22)	(0.20)	(0.11)	(0.13)	(0.03)	(0.08)	(0.08)	(0.07)	(0.06)	(0.09)	(0.14)	(0.11)	(0.09)	(0.13)
unweighted Ns	1,269	268	289	372	340	1,269	268	289	372	340	1,269	268	289	372	340
20.00 or more	1.6	2.5	2.1	1.7	1.3	21.5	21.7	21.3	21.1	21.8	2.3	2.4	2.4	2.3	2.3
(s.e.)	(0.10)	(0.41)	(0.19)	(0.13)	(0.07)	(0.09)	(0.57)	(0.17)	(0.08)	(0.10)	(0.12)	(0.22)	(0.19)	(0.15)	(0.11)
unweighted Ns	747	62	113	194	378	747	62	113	194	378	747	62	113	194	378
Vocational credits															
0.00–3.99	1.9	2.3	2.0	2.0	1.6	19.0	17.5	18.2	18.7	20.0	2.9	3.2	3.2	2.8	2.7
(s.e.)	(0.05)	(0.08)	(0.07)	(0.07)	(0.06)	(0.13)	(0.24)	(0.19)	(0.13)	(0.14)	(0.10)	(0.14)	(0.16)	(0.11)	(0.11)
unweighted Ns	1,732	268	325	487	652	1,732	268	325	487	652	1,732	268	325	487	652
4.00–7.99	5.5	5.7	5.6	5.3	5.1	15.2	14.6	14.9	15.7	17.0	2.7	2.9	2.7	2.6	2.3
(s.e.)	(0.04)	(0.06)	(0.06)	(0.08)	(0.08)	(0.18)	(0.27)	(0.23)	(0.23)	(0.22)	(0.09)	(0.10)	(0.11)	(0.11)	(0.17)
unweighted Ns	1,069	391	314	248	116	1,069	391	314	248	116	1,069	391	314	248	116
8.00 or more	9.3	9.6	9.2	8.9	—	12.6	12.2	12.9	13.0	—	2.3	2.3	2.2	2.5	—
(s.e.)	(0.12)	(0.18)	(0.13)	(0.15)	(—)	(0.23)	(0.26)	(0.32)	(0.36)	(—)	(0.12)	(0.14)	(0.13)	(0.19)	(—)
unweighted Ns	322	163	112	39	8	322	163	112	39	8	322	163	112	39	8

—Not enough cases for a reliable estimate.
[1]Students eligible for both college preparatory and vocational specializations are included in the college preparatory group.
[2]See text for a complete description of category definitions.
[3]Students in this category must also have taken at least two years of science and social studies.
[4]Students in this category must also have taken at least two years of mathematics, science, and social studies.

NOTE: Quartile assessment score ranges are as follows: below 268, 268–293, 294–322, and 323 or higher.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 9—Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP reading assessment score quartiles and curriculum characteristics: 1990

Curriculum characteristics	Credits in vocational courses					Credits in academic courses					Credits in personal use courses				
		NAEP score quartile					NAEP score quartile					NAEP score quartile			
	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Total	3.9	5.1	4.4	3.5	2.3	17.1	15.2	16.3	17.5	19.3	2.7	3.0	2.8	2.6	2.5
(s.e.)	(0.12)	(0.19)	(0.16)	(0.13)	(0.11)	(0.15)	(0.21)	(0.18)	(0.16)	(0.19)	(0.09)	0.11	0.11	0.10	0.10
unweighted Ns	3,106	787	779	769	771	3,106	787	779	769	771	3,106	787	779	769	771
Curricular specialization[1]															
College preparatory	2.2	3.0	2.7	2.4	1.8	19.8	19.0	19.2	19.6	20.4	2.5	2.8	2.7	2.4	2.5
(s.e.)	(0.11)	(0.21)	(0.16)	(0.13)	(0.11)	(0.13)	(0.17)	(0.16)	(0.15)	(0.17)	(0.09)	(0.16)	(0.08)	(0.13)	(0.10)
unweighted Ns	1,086	95	213	306	472	1,086	95	213	306	472	1,086	95	213	306	472
Vocational	7.0	7.3	7.3	6.6	6.1	13.9	13.4	13.5	14.7	15.5	2.5	2.7	2.4	2.4	2.4
(s.e.)	(0.12)	(0.17)	(0.17)	(0.13)	(0.30)	(0.14)	(0.20)	(0.19)	(0.30)	(0.25)	(0.11)	(0.13)	(0.15)	(0.14)	(0.14)
unweighted Ns	715	289	201	160	65	715	289	201	160	65	715	289	201	160	65
All others	3.3	3.9	3.7	3.0	2.2	16.8	15.8	16.2	17.2	18.5	3.0	3.2	3.1	2.9	2.7
(s.e.)	(0.12)	(0.19)	(0.18)	(0.17)	(0.12)	(0.19)	(0.24)	(0.20)	(0.24)	(0.33)	(0.11)	(0.13)	(0.14)	(0.12)	(0.16)
unweighted Ns	1,305	403	365	303	234	1,305	403	365	303	234	1,305	403	365	303	234
Compliance with *A Nation at Risk* recommendations[2]															
All requirements	2.7	3.6	3.3	2.7	2.4	19.7	19.1	19.1	19.5	20.3	2.5	3.0	2.5	2.4	2.4
(s.e.)	(0.13)	(0.32)	(0.23)	(0.15)	(0.15)	(0.15)	(0.30)	(0.28)	(0.15)	(0.24)	(0.10)	(0.21)	(0.14)	(0.13)	(0.13)
unweighted Ns	466	44	91	134	197	466	44	91	134	197	466	44	91	134	197
English, math, science, and social studies	2.6	3.7	3.1	2.5	1.8	19.1	17.8	18.4	19.1	20.2	2.7	2.9	2.8	2.7	2.5
(s.e.)	(0.16)	(0.32)	(0.20)	(0.16)	(0.17)	(0.18)	(0.37)	(0.20)	(0.22)	(0.17)	(0.09)	(0.14)	(0.12)	(0.15)	(0.10)
unweighted Ns	884	164	196	223	301	884	164	196	223	301	884	164	196	223	301
English and math[3]	4.1	4.9	4.3	3.9	2.7	16.7	15.5	16.4	17.0	18.8	2.8	2.8	3.0	2.7	2.5
(s.e.)	(0.18)	(0.26)	(0.29)	(0.24)	(0.21)	(0.23)	(0.26)	(0.30)	(0.21)	(0.43)	(0.13)	(0.16)	(0.18)	(0.16)	(0.20)
unweighted Ns	624	184	173	166	101	624	184	173	166	101	624	184	173	166	101
English[4]	5.0	5.4	5.1	4.9	3.5	15.2	14.5	15.1	15.4	17.3	2.7	3.0	2.7	2.5	2.2
(s.e.)	(0.15)	(0.22)	(0.29)	(0.31)	(0.26)	(0.15)	(0.20)	(0.28)	(0.25)	(0.41)	(0.12)	(0.16)	(0.15)	(0.23)	(0.14)
unweighted Ns	473	174	149	95	55	473	174	149	95	55	473	174	149	95	55
All others	4.9	6.1	5.6	4.2	2.6	15.0	13.4	14.1	16.1	17.6	2.9	3.0	2.8	2.8	2.9
(s.e.)	(0.33)	(0.33)	(0.34)	(0.39)	(0.37)	(0.36)	(0.37)	(0.30)	(0.54)	(0.69)	(0.12)	(0.17)	(0.18)	(0.14)	(0.18)
unweighted Ns	659	221	170	151	117	659	221	170	151	117	659	221	170	151	117

Table 9—Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP reading assessment score quartiles and curriculum characteristics: 1990—Continued

Curriculum characteristics	Credits in vocational courses					Credits in academic courses					Credits in personal use courses				
		NAEP score quartile					NAEP score quartile					NAEP score quartile			
	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Academic credits															
0.00–11.99	8.1	8.2	8.4	—	—	10.5	10.5	10.5	—	—	2.9	3.0	2.7	—	—
(s.e.)	(0.37)	(0.49)	(0.54)	(—)	(—)	(0.11)	(0.17)	(0.15)	(—)	(—)	(0.18)	(0.20)	(0.31)	(—)	(—)
unweighted Ns	146	72	47	20	7	146	72	47	20	7	146	72	47	20	7
12.00–15.99	5.8	6.0	5.8	5.6	5.3	14.0	13.7	14.0	14.2	14.4	2.9	3.0	2.9	2.8	3.1
(s.e.)	(0.15)	(0.16)	(0.21)	(0.22)	(0.45)	(0.06)	(0.07)	(0.10)	(0.09)	(0.12)	(0.10)	(0.15)	(0.12)	(0.13)	(0.20)
unweighted Ns	892	365	281	184	62	892	365	281	184	62	892	365	281	184	62
16.00–19.99	3.1	3.4	3.2	3.1	2.8	17.8	17.5	17.7	17.9	18.0	2.7	2.9	2.8	2.6	2.7
(s.e.)	(0.11)	(0.19)	(0.15)	(0.13)	(0.14)	(0.04)	(0.07)	(0.07)	(0.08)	(0.08)	(0.10)	(0.13)	(0.14)	(0.11)	(0.13)
unweighted Ns	1,334	292	320	381	341	1,334	292	320	381	341	1,334	292	320	381	341
20.00 or more	1.6	2.3	2.1	1.6	1.3	21.6	21.7	21.2	21.5	21.8	2.3	2.9	2.4	2.3	2.2
(s.e.)	(0.12)	(0.56)	(0.13)	(0.14)	(0.10)	(0.11)	(0.51)	(0.13)	(0.16)	(0.11)	(0.10)	(0.25)	(0.13)	(0.17)	(0.10)
unweighted Ns	734	58	131	184	361	734	58	131	184	361	734	58	131	184	361
Vocational credits															
0.00–3.99	1.8	2.1	2.0	1.9	1.6	19.0	17.6	18.4	19.0	20.0	2.8	3.3	3.0	2.7	2.6
(s.e.)	(0.05)	(0.07)	(0.07)	(0.06)	(0.08)	(0.16)	(0.21)	(0.18)	(0.17)	(0.23)	(0.10)	(0.13)	(0.12)	(0.12)	(0.10)
unweighted Ns	1,716	284	365	457	610	1,716	284	365	457	610	1,716	284	365	457	610
4.00–7.99	5.4	5.6	5.6	5.3	5.1	15.3	14.6	15.0	15.8	17.1	2.7	2.9	2.7	2.5	2.3
(s.e.)	(0.04)	(0.06)	(0.07)	(0.07)	(0.08)	(0.15)	(0.22)	(0.21)	(0.20)	(0.22)	(0.10)	(0.14)	(0.14)	(0.11)	(0.16)
unweighted Ns	1,106	365	331	260	150	1,106	365	331	260	150	1,106	365	331	260	150
8.00 or more	9.4	9.4	9.6	9.0	—	12.7	12.5	12.4	13.3	—	2.3	2.4	2.2	2.4	—
(s.e.)	(0.15)	(0.17)	(0.27)	(0.15)	(—)	(0.40)	(0.41)	(0.38)	(0.76)	(—)	(0.15)	(0.20)	(0.13)	(0.23)	(—)
unweighted Ns	284	138	83	52	11	284	138	83	52	11	284	138	83	52	11

—Not enough cases for a reliable estimate.
[1]Students eligible for both college preparatory and vocational specializations are included in the college preparatory group.
[2]See text for a complete description of category definitions.
[3]Students in this category must also have taken at least two years of science and social studies.
[4]Students in this category must also have taken at least two years of mathematics, science, and social studies.

NOTE: Quartile assessment score ranges are as follows: below 268, 268–291, 292–312, and 313 or higher.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 10—Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP mathematics assessment score quartiles and selected background characteristics: 1990

Student characteristics	Credits in vocational courses					Credits in academic courses					Credits in personal use courses				
		NAEP score quartile					NAEP score quartile					NAEP score quartile			
	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Total	3.9	5.7	4.6	3.2	2.3	17.1	14.7	16.0	18.1	19.5	2.7	2.9	2.8	2.6	2.6
(s.e.)	(0.11)	(0.17)	(0.16)	(0.15)	(0.09)	(0.16)	(0.25)	(0.19)	(0.19)	(0.16)	(0.08)	(0.10)	(0.09)	(0.10)	(0.10)
unweighted Ns	3,061	776	727	780	778	3,061	776	727	780	778	3,061	776	727	780	778
Sex															
Male	4.1	5.8	4.8	3.5	2.5	16.5	14.1	15.2	17.3	19.1	2.9	3.1	3.0	2.9	2.6
(s.e.)	(0.13)	(0.20)	(0.19)	(0.22)	(0.12)	(0.17)	(0.20)	(0.21)	(0.26)	(0.17)	(0.09)	(0.13)	(0.12)	(0.13)	(0.11)
unweighted Ns	1,445	371	318	345	411	1,445	371	318	345	411	1,445	371	318	345	411
Female	3.8	5.6	4.4	2.9	2.1	17.6	15.2	16.6	18.7	20.0	2.6	2.7	2.7	2.4	2.6
(s.e.)	(0.12)	(0.21)	(0.17)	(0.14)	(0.11)	(0.17)	(0.37)	(0.19)	(0.19)	(0.21)	(0.09)	(0.11)	(0.10)	(0.10)	(0.12)
unweighted Ns	1,616	405	409	435	367	1,616	405	409	435	367	1,616	405	409	435	367
Race-ethnicity*															
White, non-Hispanic	3.9	6.2	4.8	3.3	2.3	17.1	13.9	15.5	18.0	19.5	2.6	2.7	2.8	2.6	2.6
(s.e.)	(0.13)	(0.24)	(0.19)	(0.18)	(0.08)	(0.18)	(0.24)	(0.22)	(0.22)	(0.19)	(0.09)	(0.14)	(0.10)	(0.10)	(0.10)
unweighted Ns	2,236	410	518	640	668	2,236	410	518	640	668	2,236	410	518	640	668
Black, non-Hispanic	4.3	5.3	3.8	2.6	—	17.0	15.9	17.5	19.2	—	3.0	3.1	2.9	3.0	—
(s.e.)	(0.23)	(0.27)	(0.34)	(0.20)	(—)	(0.33)	(0.58)	(0.26)	(0.37)	(—)	(0.15)	(0.18)	(0.16)	(0.29)	(—)
unweighted Ns	440	228	126	65	21	440	228	126	65	21	440	228	126	65	21
Hispanic	3.9	4.7	3.9	2.9	—	16.7	15.3	17.2	17.7	—	3.3	3.5	3.2	3.0	—
(s.e.)	(0.19)	(0.32)	(0.33)	(0.35)	(—)	(0.40)	(0.42)	(0.50)	(0.51)	(—)	(0.17)	(0.25)	(0.19)	(0.28)	(—)
unweighted Ns	255	119	64	43	29	255	119	64	43	29	255	119	64	43	29
Asian/Pacific Islander	2.9	—	—	—	2.3	18.7	—	—	—	20.1	2.8	—	—	—	2.7
(s.e.)	(0.66)	(—)	(—)	(—)	(0.54)	(0.57)	(—)	(—)	(—)	(0.26)	(0.36)	(—)	(—)	(—)	(0.39)
unweighted Ns	108	15	12	26	55	108	15	12	26	55	108	15	12	26	55

Table 10—Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP mathematics assessment score quartiles and selected background characteristics: 1990—Continued

Student characteristics	Credits in vocational courses					Credits in academic courses					Credits in personal use courses				
		NAEP score quartile					NAEP score quartile					NAEP score quartile			
	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Parents' educational attainment															
Less than high school graduate	5.4	6.2	4.8	—	—	15.3	14.1	16.1	—	—	2.7	2.7	2.7	—	—
(s.e.)	(0.23)	(0.34)	(0.27)	(—)	(—)	(0.29)	(0.38)	(0.41)	(—)	(—)	(0.13)	(0.18)	(0.18)	(—)	(—)
unweighted Ns	244	129	67	27	21	244	129	67	27	21	244	129	67	27	21
High school graduate	5.0	6.0	5.3	3.6	2.8	15.9	14.3	15.3	18.2	18.8	2.7	3.0	2.6	2.4	2.4
(s.e.)	(0.17)	(0.20)	(0.24)	(0.30)	(0.21)	(0.21)	(0.29)	(0.24)	(0.33)	(0.34)	(0.12)	(0.14)	(0.15)	(0.16)	(0.18)
unweighted Ns	708	257	225	148	78	708	257	225	148	78	708	257	225	148	78
Some postsecondary education	3.8	5.5	4.1	3.5	2.4	17.1	15.0	16.1	17.4	19.4	2.8	2.8	3.1	2.8	2.5
(s.e.)	(0.11)	(0.23)	(0.24)	(0.19)	(0.11)	(0.16)	(0.27)	(0.25)	(0.24)	(0.22)	(0.09)	(0.13)	(0.15)	(0.12)	(0.14)
unweighted Ns	831	183	198	254	196	831	183	198	254	196	831	183	198	254	196
Bachelor's degree or higher	3.1	5.2	4.2	2.7	2.1	18.2	15.3	16.5	18.6	19.8	2.7	3.0	2.9	2.6	2.6
(s.e.)	(0.13)	(0.25)	(0.25)	(0.15)	(0.12)	(0.17)	(0.33)	(0.23)	(0.21)	(0.19)	(0.10)	(0.17)	(0.13)	(0.11)	(0.11)
unweighted Ns	1,210	168	221	343	478	1,210	168	221	343	478	1,210	168	221	343	478

—Not enough cases for a reliable estimate.
*The number of American Indians in the sample is too small for reliable estimates.

NOTE: Quartile assessment score ranges are as follows: below 272, 272–296, 297–319, and 320 or higher.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 11—Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP science assessment score quartiles and selected background characteristics: 1990

Student characteristics	Credits in vocational courses					Credits in academic courses					Credits in personal use courses				
		NAEP score quartile					NAEP score quartile					NAEP score quartile			
	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Total	3.9	5.5	4.6	3.4	2.2	17.0	15.0	16.0	17.4	19.5	2.7	2.9	2.8	2.7	2.6
(s.e.)	(0.11)	(0.17)	(0.13)	(0.12)	(0.10)	(0.14)	(0.20)	(0.18)	(0.16)	(0.15)	(0.08)	(0.09)	(0.11)	(0.08)	(0.10)
unweighted	3,123	822	751	774	776	3,123	822	751	774	776	3,123	822	751	774	776
Sex															
Male	4.1	5.7	5.0	3.8	2.4	16.6	14.3	15.2	16.6	19.3	2.9	3.1	3.0	2.9	2.6
(s.e.)	(0.12)	(0.20)	(0.20)	(0.16)	(0.10)	(0.15)	(0.19)	(0.22)	(0.16)	(0.15)	(0.10)	(0.13)	(0.13))	(0.12)	(0.12)
unweighted Ns	1,442	349	315	339	439	1,442	349	315	339	439	1,442	349	315	339	439
Female	3.8	5.3	4.3	3.2	1.9	17.4	15.5	16.7	18.1	19.9	2.6	2.7	2.6	2.5	2.6
(s.e.)	(0.11)	(0.18)	(0.15)	(0.14)	(0.13)	(0.16)	(0.24)	(0.21)	(0.22)	(0.20)	(0.08)	(0.10)	(0.11)	(0.08)	(0.11)
unweighted Ns	1,681	473	436	435	337	1,681	473	436	435	337	1,681	473	436	435	337
Race-ethnicity*															
White, non-Hispanic	3.9	6.0	4.8	3.6	2.2	14.2	17.0	15.6	17.2	19.4	2.7	2.7	2.8	2.6	2.6
(s.e.)	(0.12)	(0.23)	(0.16)	(0.14)	(0.10)	(0.17)	(0.24)	(0.20)	(0.19)	(0.17)	(0.09)	(0.11)	(0.13)	(0.09)	(0.10)
unweighted Ns	2,208	397	520	625	666	2,208	397	520	625	666	2,208	397	520	625	666
Black, non-Hispanic	4.1	4.8	3.7	2.4	—	15.9	16.9	17.3	19.2	—	2.9	3.0	2.9	2.5	—
(s.e.)	(0.21)	(0.26)	(0.32)	(0.36)	(—)	(0.23)	(0.33)	(0.38)	(0.53)	(—)	(0.13)	(0.12)	(0.16)	(0.32)	(—)
unweighted Ns	409	247	108	41	13	409	247	108	41	13	409	247	108	41	13
Hispanic	4.1	5.3	4.1	2.7	2.7	16.9	15.7	16.8	17.7	19.7	3.1	3.0	3.2	3.5	2.8
(s.e.)	(0.20)	(0.33)	(0.31)	(0.30)	(0.30)	(0.48)	(0.56)	(0.63)	(0.57)	(0.64)	(0.16)	(0.22)	(0.17)	(0.26)	(0.22)
unweighted Ns	318	137	83	64	34	318	137	83	64	34	318	137	83	64	34
Asian/Pacific Islander	2.9	—	4.5	2.4	1.7	18.5	—	16.8	19.2	20.1	2.8	—	2.5	2.7	2.8
(s.e.)	(0.73)	(—)	(0.42)	(0.75)	(0.30)	(0.86)	(—)	(1.1)	(0.34)	(0.33)	(0.19)	(—)	(0.16)	(0.37)	(0.19)
unweighted Ns	154	26	32	37	59	154	26	32	37	59	154	26	32	37	59

Table 11—Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP science assessment score quartiles and selected background characteristics: 1990—Continued

Student characteristics	Credits in vocational courses					Credits in academic courses					Credits in personal use courses				
		NAEP score quartile					NAEP score quartile					NAEP score quartile			
	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Parents' educational attainment															
Less than high school graduate	5.9	6.8	5.7	4.5	—	15.1	13.9	15.6	16.5	—	2.6	2.5	2.4	2.7	—
(s.e.)	(0.33)	(0.46)	(0.47)	(0.47)	(—)	(0.31)	(0.43)	(0.47)	(0.46)	(—)	(0.16)	(0.22)	(0.19)	(0.20)	(—)
unweighted Ns	251	123	67	46	15	251	123	67	46	15	251	123	67	46	15
High school graduate	5.0	5.7	5.6	4.0	3.1	15.8	14.5	15.1	16.9	19.2	2.6	2.8	2.5	2.6	2.3
(s.e.)	(0.16)	(0.23)	(0.20)	(0.20)	(0.21)	(0.21)	(0.26)	(0.23)	(0.28)	(0.27)	(0.09)	(0.10)	(0.12)	(0.11)	(0.23)
unweighted Ns	726	283	200	169	74	726	283	200	169	74	726	283	200	169	74
Some postsecondary education	3.7	5.0	4.3	3.4	2.2	17.1	15.7	16.1	17.5	18.9	2.7	2.8	2.9	2.5	2.8
(s.e.)	(0.12)	(0.21)	(0.20)	(0.15)	(0.12)	(0.15)	(0.33)	(0.15)	(0.19)	(0.27)	(0.10)	(0.13)	(0.12)	(0.12)	(0.16)
unweighted Ns	846	190	219	242	195	846	190	219	242	195	846	190	219	242	195
Bachelor's degree or higher	3.0	4.7	3.8	3.0	2.0	18.1	15.7	16.9	17.8	19.9	2.8	3.0	3.1	2.9	2.6
(s.e.)	(0.13)	(0.26)	(0.18)	(0.16)	(0.13)	(0.18)	(0.33)	(0.28)	(0.22)	(0.18)	(0.09)	(0.15)	(0.16)	(0.10)	(0.09)
unweighted Ns	1,227	175	251	311	490	1,227	175	251	311	490	1,227	175	251	311	490

—Not enough cases for a reliable estimate.
*The number of American Indians in the sample is too small for reliable estimates.

NOTE: Quartile assessment score ranges are as follows: below 268, 268–293, 294–322, and 323 or higher.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 12—Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP reading assessment score quartiles and selected background characteristics: 1990

Student characteristics	Credits in vocational courses					Credits in academic courses					Credits in personal use courses				
		NAEP score quartile					NAEP score quartile					NAEP score quartile			
	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Total	3.9	5.1	4.4	3.5	2.3	17.1	15.2	16.3	17.5	19.3	2.7	3.0	2.8	2.6	2.5
(s.e.)	(0.12)	(0.19)	(0.16)	(0.13)	(0.11)	(0.15)	(0.21)	(0.18)	(0.16)	(0.19)	(0.09)	0.11	0.11	0.10	0.10
unweighted Ns	3,106	787	779	769	771	3,106	787	779	769	771	3,106	787	779	769	771
Sex															
Male	4.0	4.9	4.4	3.6	2.6	16.6	14.9	15.9	17.3	18.7	2.9	3.2	2.9	2.7	2.7
(s.e.)	(0.18)	(0.11)	(0.17)	(0.16)	(0.11)	(0.20)	(0.14)	(0.19)	(0.16)	(0.26)	(0.10)	(0.12)	(0.14)	(0.12)	(0.13)
unweighted Ns	1,462	461	346	331	324	1,462	461	346	331	324	1,462	461	346	331	324
Female	3.7	5.3	4.4	3.5	2.2	17.6	15.6	16.5	17.7	19.8	2.6	2.7	2.7	2.6	2.4
(s.e.)	(0.15)	(0.27)	(0.21)	(0.15)	(0.14)	(0.18)	(0.30)	(0.26)	(0.23)	(0.18)	(0.09)	(0.13)	(0.11)	(0.12)	(0.10)
unweighted Ns	1,644	326	433	438	447	1,644	326	433	438	447	1,644	326	433	438	447
Race-ethnicity*															
White, non-Hispanic	3.8	5.5	4.6	3.6	2.3	17.1	14.7	16.1	17.4	19.3	2.7	2.8	2.8	2.6	2.5
(s.e.)	(0.13)	(0.22)	(0.20)	(0.13)	(0.12)	(0.17)	(0.25)	(0.20)	(0.17)	(0.20)	(0.09)	(0.11)	(0.12)	(0.11)	(0.11)
unweighted Ns	2,256	431	556	593	676	2,256	431	556	593	676	2,256	431	556	593	676
Black, non-Hispanic	4.3	4.8	4.2	3.3	—	16.6	15.8	16.6	17.7	—	2.9	3.1	2.8	2.8	—
(s.e.)	(0.23)	(0.29)	(0.28)	(0.31)	(—)	(0.28)	(0.38)	(0.37)	(0.47)	(—)	(0.15)	(0.18)	(0.14)	(0.31)	(—)
unweighted Ns	400	189	107	79	25	400	189	107	79	25	400	189	107	79	25
Hispanic	3.7	4.4	3.9	3.4	2.3	17.1	16.1	17.0	17.5	19.7	3.1	3.4	3.0	3.1	2.5
(s.e.)	(0.19)	(0.34)	(0.31)	(0.30)	(0.36)	(0.24)	(0.30)	(0.38)	(0.50)	(0.72)	(0.15)	(0.17)	(0.24)	(0.18)	(0.26)
unweighted Ns	288	121	72	59	36	288	121	72	59	36	288	121	72	59	36
Asian/Pacific Islander	2.8	2.7	3.6	2.8	2.0	18.5	17.2	17.6	19.1	20.4	2.7	3.2	2.6	2.7	2.5
(s.e.)	(0.46)	(0.66)	(0.25)	(0.44)	(0.37)	(0.52)	(0.91)	(0.48)	(0.44)	(0.54)	(0.28)	(0.21)	(0.57)	(0.27)	(0.25)
unweighted Ns	138	39	37	31	31	138	39	37	31	31	138	39	37	31	31

Table 12—Average number of credits earned by public high school graduates in vocational, academic, and personal use courses, by NAEP reading assessment score quartiles and selected background characteristics: 1990—Continued

Student characteristics	Credits in vocational courses					Credits in academic courses					Credits in personal use courses				
		NAEP score quartile					NAEP score quartile					NAEP score quartile			
	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%	All students	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Parents' educational attainment															
Less than high school graduate	5.4	5.6	5.6	4.9	—	15.4	14.6	15.1	16.7	—	2.8	2.9	2.7	2.7	—
(s.e.)	(0.19)	(0.31)	(0.28)	(0.34)	(—)	(0.22)	(0.32)	(0.37)	(0.51)	(—)	(0.13)	(0.19)	(0.18)	(0.19)	(—)
unweighted Ns	257	100	85	58	14	257	100	85	58	14	257	100	85	58	14
High school graduate	4.9	5.6	5.4	3.8	3.8	15.8	14.6	15.1	17.2	17.8	2.6	2.8	2.6	2.4	2.3
(s.e.)	(0.15)	(0.22)	(0.27)	(0.21)	(0.31)	(0.17)	(0.23)	(0.25)	(0.26)	(0.26)	(0.11)	(0.12)	(0.15)	(0.16)	(0.16)
unweighted Ns	737	251	212	173	101	737	251	212	173	101	737	251	212	173	101
Some postsecondary education	3.8	5.3	3.9	3.8	2.5	17.1	15.2	16.7	17.3	18.8	2.8	3.0	2.9	2.5	2.8
(s.e.)	(0.20)	(0.34)	(0.27)	(0.17)	(0.13)	(0.25)	(0.38)	(0.32)	(0.26)	(0.24)	(0.09)	(0.14)	(0.13)	(0.13)	(0.14)
unweighted Ns	805	167	214	213	211	805	167	214	213	211	805	167	214	213	211
Bachelor's degree or higher	3.0	4.2	3.6	3.0	1.9	18.2	16.0	17.3	18.0	20.0	2.8	3.1	2.9	2.8	2.5
(s.e.)	(0.12)	(0.24)	(0.17)	(0.18)	(0.13)	(0.19)	(0.31)	(0.22)	(0.26)	(0.26)	(0.09)	(0.14)	(0.15)	(0.12)	(0.11)
unweighted Ns	1,239	226	254	316	443	1,239	226	254	316	443	1,239	226	254	316	443

—Too few cases for a reliable estimate.
*The number of American Indians in the sample is too small for reliable estimates.

NOTE: Quartile assessment score ranges are as follows: below 268, 268–291, 292–312, and 313 or higher.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 13—Distribution of public high school graduates across levels of vocational course taking, by selected background characteristics: 1990 NAEP mathematics assessment sample

Student characteristics	Vocational credits			Unweighted Ns
	Fewer than 4.0	4.0 to 7.9	8.0 or more	
Total	55.0	34.5	10.5	3,061
(s.e.)	(1.77)	(1.51)	(1.07)	
Sex				
Male	53.6	34.0	12.4	1,445
(s.e.)	(2.13)	(1.86)	(1.46)	
Female	56.3	35.0	8.7	1,616
(s.e.)	(1.95)	(1.63)	(1.09)	
Race-ethnicity*				
White, non-Hispanic	56.1	32.5	11.3	2,236
(s.e.)	(2.20)	(1.90)	(1.23)	
Black, non-Hispanic	48.3	42.4	9.3	440
(s.e.)	(4.07)	(3.61)	(1.76)	
Hispanic	54.0	37.2	8.8	255
(s.e.)	(3.89)	(3.99)	(1.67)	
Asian/Pacific Islander	65.2	34.8	0	108
(s.e.)	(15.74)	(15.74)	(0)	
Parents' educational attainment				
Less than high school graduate	31.6	47.2	21.3	244
(s.e.)	(3.04)	(3.15)	(2.79)	
High school graduate	39.1	44.1	16.8	708
(s.e.)	(2.28)	(2.12)	(2.13)	
Some postsecondary education	55.4	37.0	7.7	831
(s.e.)	(2.23)	(2.18)	(1.13)	
Bachelor's degree or higher	69.3	24.8	5.9	1,210
(s.e.)	(2.25)	(1.93)	(0.81)	

*The number of American Indians in the sample is too small for reliable estimates.

NOTE: Percentages may not sum to 100 due to rounding.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 14—Distribution of public high school graduates across levels of vocational course taking, by selected background characteristics: 1990 NAEP science assessment sample

Student characteristics	Vocational credits			Unweighted Ns
	Fewer than 4.0	4.0 to 7.9	8.0 or more	
Total	55.4	33.7	10.9	3,123
(s.e.)	(1.67)	(1.40)	(1.16)	
Sex				
Male	54.1	34.0	11.9	1,442
(s.e.)	(1.86)	(1.65)	(1.27)	
Female	56.5	33.5	10.0	1,681
(s.e.)	(1.90)	(1.79)	(1.34)	
Race-ethnicity*				
White, non-Hispanic	55.9	32.8	11.3	2,208
(s.e.)	(1.90)	(1.61)	(1.43)	
Black, non-Hispanic	51.7	37.2	11.0	409
(s.e.)	(3.80)	(3.41)	(2.14)	
Hispanic	52.2	36.9	11.0	318
(s.e.)	(3.47)	(3.15)	(1.83)	
Asian/Pacific Islander	68.9	28.1	2.9	154
(s.e.)	(12.60)	(13.50)	(1.35)	
Parents' educational attainment				
Less than high school graduate	29.4	40.2	30.4	251
(s.e.)	(3.34)	(4.03)	(4.55)	
High school graduate	35.9	46.5	17.6	726
(s.e.)	(2.46)	(2.22)	(2.33)	
Some postsecondary education	58.0	33.9	8.1	846
(s.e.)	(1.97)	(1.77)	(1.22)	
Bachelor's degree or higher	71.2	24.2	4.5	1,227
(s.e.)	(2.13)	(1.72)	(0.78)	

*The number of American Indians in the sample is too small for reliable estimates.

NOTE: Percentages may not sum to 100 due to rounding.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 15—Distribution of public high school graduates across levels of vocational course taking, by selected background characteristics: 1990 NAEP reading assessment sample

Student characteristics	Vocational credits			Unweighted Ns
	Fewer than 4.0	4.0 to 7.9	8.0 or more	
Total	54.5	36.0	9.6	3,106
(s.e.)	(1.96)	(1.53)	(0.84)	
Sex				
Male	52.9	37.0	10.1	1,462
(s.e.)	(1.93)	(1.44)	(0.91)	
Female	55.9	35.0	9.0	1,644
(s.e.)	(2.33)	(1.94)	(1.07)	
Race-ethnicity*				
White, non-Hispanic	55.2	34.5	10.4	2,256
(s.e.)	(2.12)	(1.69)	(1.05)	
Black, non-Hispanic	46.5	44.5	9.0	400
(s.e.)	(4.10)	(3.33)	(1.82)	
Hispanic	53.4	39.8	6.8	288
(s.e.)	(4.30)	(4.31)	(2.02)	
Asian/Pacific Islander	73.4	25.4	1.2	138
(s.e.)	(9.24)	(8.13)	(1.18)	
Parents' educational attainment				
Less than high school graduate	30.8	48.7	20.5	257
(s.e.)	(3.67)	(3.53)	(2.63)	
High school graduate	38.0	46.6	15.3	737
(s.e.)	(2.19)	(1.94)	(1.47)	
Some postsecondary education	54.7	37.7	7.6	805
(s.e.)	(3.27)	(2.42)	(1.51)	
Bachelor's degree or higher	69.6	25.6	4.8	1,239
(s.e.)	(2.32)	(2.02)	(0.65)	

*The number of American Indians in the sample is too small for reliable estimates.

NOTE: Percentages may not sum to 100 due to rounding.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 16—Distribution of public high school graduates across levels of vocational course taking, by curriculum characteristics: 1990 NAEP mathematics assessment sample

Curriculum characteristics	Vocational credits			Unweighted Ns
	Fewer than 4.0	4.0 to 7.9	8.0 or more	
Total	55.0	34.5	10.5	3,061
(s.e.)	(1.77)	(1.51)	(1.07)	
Curricular specialization[1]				
College preparatory	82.3	16.3	1.4	1,076
(s.e.)	(2.40)	(2.14)	(0.51)	
Vocational	2.5	57.6	40.0	656
(s.e.)	(0.68)	(2.75)	(2.71)	
All others	61.0	36.5	2.5	1,329
(s.e.)	(2.02)	(1.94)	(0.54)	
Compliance with *A Nation at Risk* recommendations[2]				
All requirements	77.9	19.7	2.4	483
(s.e.)	(3.98)	(3.53)	(1.11)	
English, math, science, and social studies	74.4	23.2	2.5	870
(s.e.)	(2.75)	(2.26)	(0.93)	
English and math[3]	45.5	46.3	8.3	603
(s.e.)	(2.71)	(2.00)	(1.80)	
English[4]	38.7	42.9	18.5	434
(s.e.)	(3.23)	(3.04)	(1.96)	
All others	37.9	41.6	20.5	671
(s.e.)	(3.45)	(3.34)	(3.67)	
Academic credits				
0.00–11.99	2.6	27.6	69.8	145
(s.e.)	(1.41)	(5.10)	(5.30)	
12.00–15.99	20.8	59.7	19.4	880
(s.e.)	(1.67)	(2.38)	(2.33)	
16.00–19.99	65.1	33.4	1.6	1,309
(s.e.)	(2.80)	(2.62)	(0.49)	
20.00 or more	93.8	5.6	0.6	727
(s.e.)	(1.61)	(1.35)	(0.55)	
Mathematics credits				
0.00–1.99	22.7	47.0	30.3	81
(s.e.)	(6.92)	(6.24)	(8.35)	
2.00–2.99	31.4	42.8	25.8	624
(s.e.)	(2.17)	(2.97)	(2.82)	
3.00 or more	63.6	31.5	4.9	2,356
(s.e.)	(2.16)	(1.84)	(0.91)	

Table 16—Distribution of public high school graduates across levels of vocational course taking, by curriculum characteristics: 1990 NAEP mathematics assessment sample—Continued

Curriculum characteristics	Vocational credits			Unweighted Ns
	Fewer than 4.0	4.0 to 7.9	8.0 or more	
Highest mathematics course				
Trigonometry or higher[5]	78.3	20.7	1.0	1,067
(s.e.)	(2.28)	(2.28)	(0.35)	
Algebra II	59.6	35.8	4.6	769
(s.e.)	(2.37)	(2.19)	(1.0)	
Geometry	45.2	44.3	10.5	472
(s.e.)	(3.54)	(3.22)	(1.83)	
Algebra I	29.1	48.1	22.7	317
(s.e.)	(3.01)	(3.62)	(2.75)	
Less than algebra I	24.4	43.4	32.2	436
(s.e.)	(2.86)	(3.13)	(2.86)	

[1]Students eligible for both college preparatory and vocational specializations are included in the college preparatory group.
[2]See text for a complete description of category definitions.
[3]Students in this category must also have taken at least two years of science and social studies.
[4]Students in this category must also have taken at least two years of mathematics, science, and social studies.
[5]Precalculus and calculus are also included in this category.

NOTE: Percentages may not sum to 100 due to rounding.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 17—Distribution of public high school graduates across levels of vocational course taking, by curriculum characteristics: 1990 NAEP science assessment sample

Curriculum characteristics	Vocational credits			Unweighted Ns
	Fewer than 4.0	4.0 to 7.9	8.0 or more	
Total	55.4	33.7	10.9	3,123
(s.e.)	(1.67)	(1.40)	(1.16)	
Curricular specialization[1]				
College preparatory	82.6	16.6	0.9	1,080
(s.e.)	(2.25)	(2.07)	(0.37)	
Vocational	2.5	56.5	40.9	697
(s.e.)	(0.68)	(3.53)	(3.70)	
All others	63.1	34.2	2.8	1,346
(s.e.)	(2.50)	(2.45)	(0.45)	
Compliance with *A Nation at Risk* recommendations[2]				
All requirements	76.5	22.6	0.9	448
(s.e.)	(3.50)	(3.23)	(0.55)	
English, math, science, and social studies	75.5	21.1	3.4	905
(s.e.)	(2.73)	(2.26)	(0.75)	
English and math[3]	51.4	38.7	9.8	660
(s.e.)	(3.27)	(2.47)	(1.61)	
English[4]	34.6	51.3	14.1	429
(s.e.)	(2.71)	(3.11)	(2.29)	
All others	38.5	38.7	22.8	681
(s.e.)	(4.78)	(3.63)	(4.12)	
Academic credits				
0.00–11.99	4.6	35.1	60.4	161
(s.e.)	(1.63)	(6.77)	(7.14)	
12.00–15.99	19.4	59.7	21.0	946
(s.e.)	(2.37)	(2.85)	(2.61)	
16.00–19.99	70.0	28.9	1.5	1,269
(s.e.)	(2.50)	(2.32)	(0.51)	
20.00 or more	93.3	6.4	0.3	747
(s.e.)	(1.61)	(1.35)	(0.55)	

[1]Students eligible for both college preparatory and vocational specializations are included in the college preparatory group.
[2]See text for a complete description of category definitions.
[3]Students in this category must also have taken at least two years of science and social studies.
[4]Students in this category must also have taken at least two years of mathematics, science, and social studies.

NOTE: Percentages may not sum to 100 due to rounding.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 18—Distribution of public high school students across levels of vocational course taking, by curriculum characteristics: 1990 NAEP reading assessment sample

Curriculum characteristics	Vocational credits			Unweighted Ns
	Fewer than 4.0	4.0 to 7.9	8.0 or more	
Total	54.5	36.0	9.6	3,106
(s.e.)	(1.96)	(1.53)	(0.84)	
Curricular specialization[1]				
College preparatory	81.4	18.4	0.2	1,086
(s.e.)	(2.17)	(2.16)	(0.11)	
Vocational	2.8	62.5	34.7	715
(s.e.)	(0.58)	(2.10)	(2.20)	
All others	63.2	34.2	2.6	1,305
(s.e.)	(2.36)	(2.19)	(0.50)	
Compliance with *A Nation at Risk* recommendations[2]				
All requirements	73.9	25.8	0.4	466
(s.e.)	(3.00)	(2.96)	(0.26)	
English, math, science, and social studies	74.7	22.9	2.4	884
(s.e.)	(2.72)	(2.46)	(0.82)	
English and math[3]	47.3	44.2	8.5	624
(s.e.)	(3.28)	(2.86)	(1.36)	
English[4]	36.1	46.0	18.0	473
(s.e.)	(2.78)	(2.31)	(1.56)	
All others	39.3	43.0	17.8	659
(s.e.)	(4.95)	(3.33)	(2.62)	
Academic credits				
0.00–11.99	4.6	37.8	57.6	146
(s.e.)	(2.65)	(5.12)	(6.13)	
12.00–15.99	17.7	63.0	19.3	892
(s.e.)	(2.74)	(2.45)	(1.81)	
16.00–19.99	66.3	32.9	0.7	1,334
(s.e.)	(2.78)	(2.69)	(0.20)	
20.00 or more	93.7	5.6	0.7	734
(s.e.)	(1.43)	(1.25)	(0.73)	

[1]Students eligible for both college preparatory and vocational specializations are included in the college preparatory group.
[2]See text for a complete description of category definitions.
[3]Students in this category must also have taken at least two years of science and social studies.
[4]Students in this category must also have taken at least two years of mathematics, science, and social studies.

NOTE: Percentages may not sum to 100 due to rounding.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Table 19—Standard errors and unweighted Ns corresponding to table A

NAEP assessment and type of credits	NAEP assessment score quartile			
	Bottom 25%	2nd 25%	3rd 25%	Top 25%
Mathematics assessment[1]				
Total credits	0.30	0.19	0.19	0.16
Vocational credits	0.17	0.16	0.15	0.09
Academic credits	0.25	0.19	0.19	0.16
Personal use credits	0.10	0.09	0.10	0.10
unweighted Ns	776	727	780	778
Science assessment[2]				
Total credits	0.21	0.19	0.14	0.13
Vocational credits	0.17	0.13	0.12	0.10
Academic credits	0.20	0.18	0.16	0.15
Personal use credits	0.09	0.11	0.08	0.10
unweighted Ns	822	751	774	776
Reading assessment[3]				
Total credits	0.22	0.19	0.16	0.17
Vocational credits	0.19	0.16	0.13	0.11
Academic credits	0.21	0.18	0.16	0.19
Personal use credits	0.11	0.11	0.10	0.10
unweighted Ns	787	779	769	771

[1]Quartile assessment score ranges are as follows: below 272, 272–296, 297–319, and 320 or higher.
[2]Quartile assessment score ranges are as follows: below 268, 268–293, 294–322, and 323 or higher.
[3]Quartile assessment score ranges are as follows: below 268, 268–291, 292–312, and 313 or higher.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

Appendix B

Methodology and Statistical Procedures

All analyses presented in this report are based on the sample of students in the 1990 HSTS with matched NAEP assessment scores, subject to the following additional criteria:

- Only public high school graduates are included in the analysis sample; and
- Complete transcript information, defined as a transcript showing between 16 and 32 credits that includes English credits, had to be available.

The restriction to public high schools is because private schools typically offer few if any vocational courses. The restriction to graduates is to standardize students' exposure to courses and to eliminate incomplete transcripts from the analysis sample.

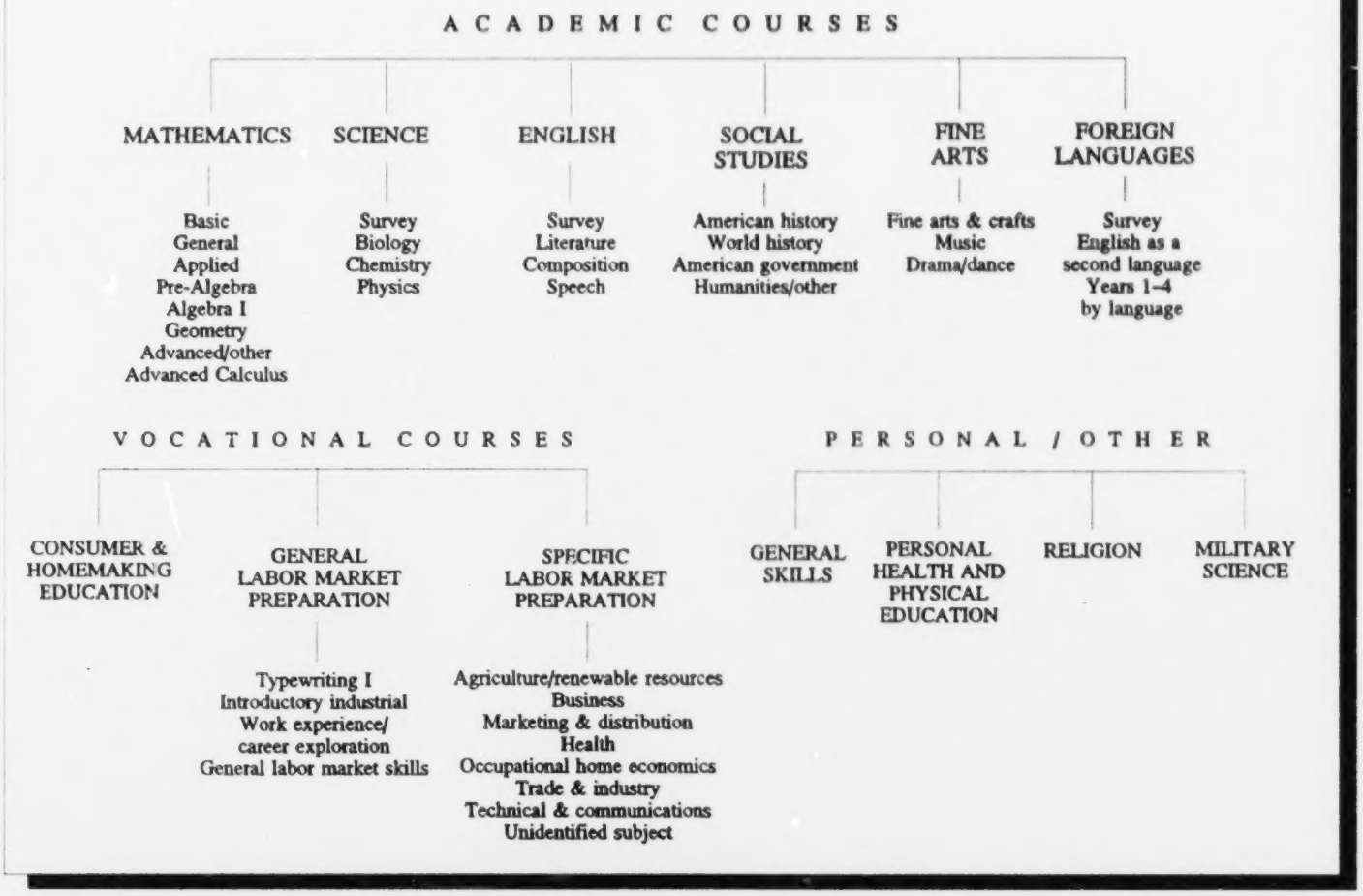
The courses in the HSTS data set were categorized according to the Secondary School Taxonomy (SST), which was developed for the National Assessment of Vocational Education (Gifford, Tuma, and Hoachlander 1989). The SST organizes transcript data into three different curricula: academic, vocational, and personal use/other (figure B.1). The academic curriculum was divided into six subject areas: mathematics, science, English, social studies, fine arts, and foreign languages. Courses within each subject area were then organized within topical concentrations, and where possible within the topical concentrations by level or degree of difficulty (basic, regular, advanced placement/honors, or specialized topics).

The joint assessment-transcript samples are unique to each assessment. Hence, students for whom we have both transcript and math assessment data constitute one sample, students for whom we have both transcript and science assessment data constitute a second sample, and students for whom we have both transcript and reading assessment data constitute a third sample. As a result, each of the joint samples is relatively small compared to the overall transcript sample. About 75 percent of the HSTS sample have any matched assessment data. Because there is no way to determine which assessment would have been taken by students who were included in the transcript sample but not in the NAEP sample, the question of bias due to non-response cannot be addressed directly. However, the overall pattern of vocational course taking for the joint assessment-transcript samples examined in this report does not differ significantly from that for the entire transcript sample (table B.1). This indirect measure suggests that the assessment samples are not biased in a way that would threaten the generalizability of the findings documented in this report.

All analyses reported here are based on weighted data to produce nationally representative estimates of course taking and achievement. Separate weights are required for each sample, and were designed to compensate for the differential probability of selection into the sample and for sample non-response. The weights were developed by WESTAT, Inc. and are included in the "Linked Weights File" of the 1990 High School Transcript Study. The reported achievement scores are means of the five NAEP plausible values. For further information about the interpretation and use of plausible value scores, see the NAEP technical report (Johnson and Allen 1992).

The comparisons in the text have all been tested for statistical significance to ensure that the differences are larger than those that might be expected due to sampling variation, and the standard errors have been adjusted to account for NAEP's complex sample design. Two types of comparisons have been made in the text, differences in estimates and trends.

Figure B.1—Organization of the Secondary School Taxonomy



SOURCE: A.G. Gifford, E.G. Hoachlander, J.E. Tuma, *The Secondary School Taxonomy*, a report prepared for the National Assessment of Vocational Education, Office of Planning, Budget, and Evaluation, U.S. Department of Education (Berkeley: MPR Associates, Inc., February 1989).

Differences in two estimates. Student's t statistic can be used to test the likelihood that the difference between two estimates (e.g., estimates of the average number of credits or the average score) is larger than would be expected due to sampling variation alone. Student's t is given by

$$t = \frac{(E_1 - E_2)}{\sqrt{se_1^2 + se_2^2}}$$

where E_1 and E_2 are the estimates to be compared and se_1 and se_2 are their corresponding standard errors.

Table B.1—Percentage distribution of public high school graduates in the 1990 High School Transcript Study sample and the joint NAEP assessment-transcript samples, by number of vocational credits completed

Sample	Vocational credits		
	Fewer than 4.0	4.0 to 7.9	8.0 or more
High School Transcript Study sample			
Total	52.0	36.3	11.7
s.e.	1.21	1.00	0.71
Unweighted Ns	16,741	16,741	16,741
Joint NAEP assessment-transcript samples			
Mathematics	55.0	34.5	10.5
s.e.	1.77	1.51	1.07
Unweighted Ns	3,061	3,061	3,061
Science	55.4	33.7	10.9
s.e.	1.67	1.40	1.16
Unweighted Ns	3,123	3,123	3,123
Reading	54.5	36.0	9.6
s.e.	1.96	1.53	0.84
Unweighted Ns	3,106	3,106	3,106

NOTE: Distribution may not sum to 100 due to rounding.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1990 High School Transcript Study, and 1990 National Assessment of Educational Progress 12th Grade Assessment File.

As the number of comparisons on the same set of data increases, the likelihood that the *t* value for at least one of the comparisons will exceed the critical value simply due to sampling error increases. For a single comparison, there is a 5 percent chance that the *t* value will exceed 1.96 due to sampling error. For five tests, the risk of getting at least one *t* value that high increases to 23 percent, and for 20 comparisons it increases to 64 percent.

One way to compensate for this problem when making multiple comparisons is the Bonferroni adjustment, which involves adjusting the alpha level (i.e., the chance of finding a false positive due to sampling error) to take into account the number of comparisons being made. For example, rather than simply establishing an alpha level of 0.05 as it would be for a single comparison, the alpha level is set to ensure that the likelihood of finding a significant *t* value by chance alone is 0.05 for a set of comparisons. The Bonferroni adjustment is calculated by taking the desired alpha level and dividing by the number of possible comparisons, based on the variable(s) being compared. The *t* value corresponding to the revised, lower alpha level must be exceeded in order for any of the comparisons to be considered significant.

The Bonferroni adjustment was applied for all significance tests in this report that involved multiple comparisons. Where categories of two variables were involved, the number of comparisons used to make the Bonferroni adjustment was based on the relationship(s) being tested.

Trends. Regression analysis was used to test for linear trends in the relationship between ordered variables. Regression analysis assesses the degree to which one variable (the dependent variable) is related to a set of other variables (the independent variables). The estimation procedure most commonly used in regression analysis is ordinary least squares (OLS).

Dependent variables for trend analysis were either the average number of credits, or the average NAEP score. Independent variables were linear contrast variables corresponding to the quartile rank on the NAEP assessment or the level of vocational course taking. Because the dependent variables for this analysis were themselves estimates with standard errors of differing magnitude, a weighted least squares procedure was used to obtain unbiased regression parameters. The weighting procedure involved creating a set of transformed dependent and independent variables by dividing all observations by the standard error of the dependent variable. In order to obtain an unbiased estimate for the constant term of the regression, the reciprocal of the weight was also entered as an independent variable. OLS regression through the origin was then applied to the transformed variables.

All transformations and regressions were performed using the data manipulation and regression capability of Microsoft Excel. Significance testing for the analysis of linear trends consisted of a two-tailed *t* test of the coefficient for the linear contrast variable. All statements about trends in this report are statistically significant at the 0.05 level.

Estimates were reported in tables if 30 or more observations were available in the sample to generate the estimate. Because of the complex sampling design used in NAEP and the use of plausible values, differences between two estimates of average NAEP scores were tested if each estimate was based on 62 or more observations. Since a trend test has greater statistical power than pairwise *t* tests, trend tests were conducted when each estimate was based on 30 or more observations.

Measures of curricular exposure. The simplest measures of students' curricular exposure are based on a count of the number of academic, vocational, or personal use credits earned. Another course-taking measure indicates overall curricular specialization and identifies three groups: college preparatory students; vocational concentrators, defined as those with at least 3.0 credits of specific labor market preparation in a single field; and all others. The college preparatory curriculum is

defined according to the breadth and depth of academic course taking: at least 4.0 credits of English; at least 3.0 credits of mathematics, with at least 1.0 credit at or above algebra I; at least 3.0 credits in science, with at least 1.0 credit in chemistry, physics, or advanced biology; and at least 2.0 credits in a single foreign language. The small number of students meeting the criteria for both the vocational and college preparatory categories was too small to report separately, and these students were included in the college preparatory group. It is likely that the average achievement scores for students classified as vocational would be higher if students who met both criteria were placed in this category.

Another measure of curriculum is compliance with the graduation requirements recommended in *A Nation at Risk*, which calls for 4 years of English, 3 years each of mathematics, science, and social studies, 2 years of a single foreign language (recommended for college-bound students), and half a year of computer science (National Commission on Excellence in Education 1983). Students' course taking is characterized here along a continuum of compliance with these recommendations as follows:

- Met all recommendations;
- Met the English, mathematics, science, and social studies recommendations; did not meet one or both of the foreign language and computer science recommendations;
- Met the English and mathematics recommendations, plus at least 2 years of science and social studies (but not three years of both);
- Met the English recommendation, plus at least 2 years of mathematics (but less than three) and at least 2 years of science and social studies; and
- All others.

While this is only one of many possible ways to capture degrees of compliance with the recommended curriculum, the measure has two desirable characteristics: it prioritizes certain subject areas (assigning greatest weight to English, followed by mathematics and then science and social studies, with the least weight assigned to foreign language and computer science), and it results in a useful empirical distribution. One must also be aware of the strengths and limitations of this approach. The last category should not necessarily be interpreted as the least rigorous, since it includes students who were excluded from the other categories due to any *one* of the following shortcomings: less than 4 years of English; less than 2 years of mathematics; less than 2 years of science; or less than 2 years of social studies. These students may have taken an otherwise rigorous curriculum. More generally, while this measure compares the list of courses completed with the standard in *A Nation at Risk*, it does not capture other important aspects of a student's educational preparation (for example, the specific content of courses, the quality of instruction, and student effort and achievement in the courses).

Two other measures assess the amount and level of exposure to the mathematics curriculum, and only appear in tables related to mathematics achievement. The first is based on a simple count of the number of mathematics courses completed, and the second on the highest level of mathematics course completed.

ISBN 0-16-048073-6

United States
Department of Education
Washington, DC 20208–5650

Official Business
Penalty for Private Use, $300

Postage and Fees Paid
U.S. Department of Education
Permit No. G–17

Third Class